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National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
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BIN C15700
Seattle, WA 98115-0070

May 12, 2003

Pierce Harrison
Project Administrator
Wapato Irrigation Project
Bureau of Indian Affairs
Post Office Box 220
Wapato, Washington 98951

Re: Endangered Species Act section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Consultation for Flood Control Measures at the Wapato Irrigation Project Main Diversion Dam on the Yakima River, Yakima County, Washington (WHB-2001/02046)

Dear Mr. Harrison:

In accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended, and the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996, the attached document transmits NOAA's National Marine Fisheries Service (NOAA Fisheries) Biological Opinion (Opinion) and MSA consultation on flood control measures and future maintenance activities on those measures at Wapato Dam in the Yakima River south of the City of Yakima, Yakima County, Washington. The Bureau of Indian Affairs (BIA) determined that the proposed action was not likely to adversely affect (NLAA) threatened steelhead of the Middle Columbia River (MCR) Evolutionarily Significant Unit (ESU). NOAA Fisheries was unable to concur with this NLAA determination, and recommended formal consultation.

The Opinion reflects the results of a formal ESA consultation and contains an analysis of effects covering MCR steelhead in the Yakima River, Washington. The Opinion is based on information provided in the Biological Assessment (BA) sent to NOAA Fisheries by the BIA, and additional information transmitted via telephone conversations and e-mail. A complete administrative record of this consultation is on file at the Washington Habitat Branch Office.

NOAA Fisheries concludes that implementation of the proposed project is not likely to jeopardize the continued existence of MCR steelhead. In your review, please note that the incidental take statement, which includes Reasonable and Prudent Measures and Terms and

Conditions, was designed to minimize take. Additionally, please note that the duration of future maintenance activities on constructed elements of the proposed project covered under this Opinion is limited to ten years.

The MSA consultation concluded that the proposed project may adversely impact designated Essential Fish Habitat (EFH) for chinook and coho salmon. The Reasonable and Prudent Measures of the ESA consultation, and Terms and Conditions identified therein, would address the negative effects resulting from the proposed BIA actions. Therefore, NOAA Fisheries recommends that they be adopted as EFH conservation measures.

Thank you for your efforts to protect MCR steelhead and their riverine environment. If you have any questions regarding this consultation, please contact Kale Gullett of the Washington Habitat Branch, Ellensburg Field Office at (509) 962-8911, extension 222.

Sincerely,

For Michael R Crouse

D. Robert Lohn
Regional Administrator

Enclosure

cc: Chane Salois, Yakama Nation

Endangered Species Act - Section 7 Consultation

Biological Opinion

And

Magnuson-Stevens Fishery Conservation and Management Act

Essential Fish Habitat Consultation

Flood Control Measures at the Wapato Irrigation Project Main Diversion Dam on the Yakima River, Yakima County, WA
WHB-2001/02046

Action Agency: Bureau of Indian Affairs

Consultation Conducted by: National Marine Fisheries Service
Northwest Region

Issued by: for Michael R Crouse   Date Issued: May 12, 2003

D. Robert Lohn
Regional Administrator

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1.0 INTRODUCTION

This document is the product of an Endangered Species Act (ESA) section 7 formal consultation and Magnuson-Stevens Fishery Conservation and Management Act (MSA) Essential Fish Habitat (EFH) consultation between NOAA's National Marine Fisheries Service (NOAA Fisheries) and the Bureau of Indian Affairs (BIA), Wapato Irrigation Project (WIP). The BIA is proposing to undertake and maintain flood control measures in the vicinity of the WIP Main Canal Diversion Dam (Wapato Dam) in the Yakima River below Union Gap, just south of the city of Yakima, Yakima County, Washington. The proposed action will occur within the geographic boundary and habitat of the Middle Columbia River (MCR) steelhead (*Oncorhynchus mykiss*) Evolutionarily Significant Unit (ESU[1]), listed as threatened under the ESA. Additionally, the proposed Action Area is designated as EFH for chinook (*O. tshawytscha*) and coho (*O. kisutch*) salmon.

The Biological Opinion (Opinion) presents NOAA Fisheries' opinion on whether the proposed action is likely to jeopardize the continued existence of the MCR steelhead ESU. Further, this document will determine if the proposed action will adversely affect designated coho and chinook salmon EFH. These ESA and EFH determinations will be reached by analyzing the biological effects of construction activities associated with flood control measures in the vicinity of Wapato Dam in the Yakima River, relating those effects to the biological and ecological needs of listed MCR steelhead, and then adding these effects to the environmental baseline of the Action Area.

1.1 Background Information

The WIP operates and maintains a network of irrigation facilities and watercourses that serve approximately 140,000 acres of arable land on the Yakama Reservation. The primary source of irrigation water for the WIP is diverted from the Yakima River via Wapato Dam, a low-head concrete structure located about a mile downstream of Union Gap, Yakima, Washington. Wapato Dam was built in 1917, and consists of two separate 9-foot high structures (East and West Dams) connected by a sheet-piling cutoff wall spanning a mid-river island between two channels of the Yakima River. Major flooding in February, 1996, and another sustained high flow event in the spring of 1997 contributed to substantial damage along Wapato Dam structures including:

- Major undercutting along the spillway apron of the East Dam;
- Scouring along the left abutment of the West Dam spillway;
- Overtopping and scouring along the downstream face of the sheet-piling cutoff wall connecting the East and West Dams across the mid-channel island;

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[1]"ESU" means a population or group of populations that is considered distinct (and hence a "species") for purposes of conservation under the ESA. To qualify as an ESU, a population must (1) be reproductively isolated from other conspecific populations, and (2) represent an important component in the evolutionary legacy of the biological species (Waples 1991).

- Toe scour along the sheet-piling wall that protects a railroad grade and highway upstream of Wapato Dam on the right bank of the river;
- Bedload deposition in the Yakima River upstream of Wapato Dam that altered local water surface elevations, thus affecting static head on the WIP Main Canal.

Interim protection measures were taken by WIP before the listing of MCR steelhead to ensure adequate flow into the Main Canal, shore up the mid-channel island cut-off wall that remained scoured and uncovered by high water, and repair other associated structures damaged by flooding. However, in response to damage at the Wapato Dam and other WIP facilities across the Yakama Reservation, the BIA, with assistance from the Yakama Nation (YN), produced a plan detailing comprehensive flood control measures to repair existing flood damage, prevent or reduce future flood damage to facilities, improve fish passage conditions, and encourage more natural interactions between the Yakima River and its floodplain in the vicinity of WIP facilities.

The proposed action is the result of a BIA flood control planning effort. The action under consultation includes the installation of eight rock drop structures upstream and downstream of Wapato Dam, two instream rock barbs above Wapato Dam on the right bank of the Yakima River, two floodplain cutoff dikes on the right bank of the River, and removal of a large floodplain stockpile of cobble and gravel that has accumulated from regular maintenance activities at the upstream the mid-river island. Further description of this project is provided in Section 1.3, below.

1.2 Consultation History

The proposed action is a continuation of activities that have previously undergone formal ESA section 7 consultation between NOAA Fisheries and the BIA. The action under consultation was originally a component of a larger project for which the BIA requested formal consultation on March 20, 2001. Upon review of the scope and magnitude of the larger BIA flood control project, NOAA Fisheries recommended that activities at Wapato Dam be delayed until further consultation between the BIA and YN Tribal Council and Tribal fisherman occurred to review affects on cultural resources. The BIA agreed, and NOAA Fisheries completed formal consultation on a portion of the larger project on August 21, 2001, when an Opinion was issued providing coverage for flood control measures at Olney Dam (WSB-01-066), a WIP facility on Toppenish Creek, a tributary to the Yakima River on the Yakama Reservation.

The BIA, in cooperation with the YN Fisheries Resource Management Program and at the request of NOAA Fisheries, explained the scope and magnitude of flood control measures at Wapato Dam to the YN Tribal Council, Tribal fishers, and all appropriate Programs of the YN. These consultations resulted in Council and Tribal approval of the proposed action. The BIA requested consultation on October 8, 2002, through re-submission of a revised Biological Assessment (BA) that determined that the proposed action “may affect” but was “not likely to adversely affect (NLAA)” threatened MCR steelhead in the action area. NOAA Fisheries was unable to agree with the NLAA determination, and met with the BIA and project personnel onsite on October 25, 2002. While at this meeting, NOAA Fisheries advised the BIA that the

BA lacked vital information, and recommended formal consultation. The BIA and project personnel agreed, and NOAA Fisheries worked through BA deficiencies with project consultants and representatives until adequate information to initiate formal consultation was received on February 7, 2003. The formal consultation process involved reviewing information contained in the project BA, its subsequent addenda, and correspondence and communication between the BIA, its consultants, and NOAA Fisheries (phone calls, meetings, and electronic mail (e-mail)). NOAA Fisheries reviewed the following information and engaged in the following steps to reach its determination and prepare this consultation:

1. October 8, 2002 receipt in Lacey, Washington of letter from BIA informing NOAA Fisheries of further coordination with and agreement from YN Tribal Council and Tribal fishers on Wapato Dam portion of flood control project, and requesting consultation (NOAA Fisheries No. WHB-2001/02046).

2. October 25, 2002 onsite meeting with BIA, its consultants, and YN; NOAA Fisheries advised formal consultation and requested additional information, including submission of a copy of the most recent project BA.

3. Late November, 2002 receipt of project BA, hand-delivered by YN representative to the Ellensburg Field Office.

4. February 7, 2003 receipt of e-mail from BIA consultant responding to requests for information from NOAA Fisheries; information requirements met for initiation of formal consultation.

In addition to the key events listed above, other information was informally transferred via email and phone calls between the BIA, its consultants, and NOAA Fisheries during the completion of this consultation. These documents and a record of communications are part of the consultation history on file at NOAA Fisheries, Washington Habitat Branch Office.

1.3 Description of the Proposed Action

The BIA proposes to undertake flood control measures in the vicinity of Wapato Dam, including the construction of numerous instream rock structures, creation of an overflow channel down the left margin of a mid-river island in the Yakima River, removal of stockpiled bedload accumulated from maintenance activities, and structural protection of capital facilities, road and railways in the project area. The proposed action is centered around Wapato Dam (River Mile (RM) 106.6; Lat. 46.5240 °N, Long. 120.4770 °W), a structure consisting of two channel-spanning, low-head concrete structures in the Yakima River just downstream of Union Gap, about a mile south of the city of Yakima (Figure 1). The Yakima River roughly flows from north to south at this location, and is split into two branches by a large island. Thus, Wapato Dam consists of two separate structures, the East and West Dams, connected by a driven sheet-piling cutoff wall that spans the upstream end of the mid-river island. The East Dam is 420 feet long, and is outfitted with two vertical slot fishways-one near the center and the second on the right abutment. The West Dam is 200 feet long, and houses a single vertical slot fishway near the center of the structure.

Flood events in 1996 and 1997, combined with other runoff spates in the 85 years since Wapato Dam was built, have collectively damaged the East and West Dams, altered channel morphology

Figure 1. Annotated aerial photograph of Wapato Dam (RM 106.6) on the Yakima River south of the city of Yakima, WA, taken spring, 2002. Photo courtesy of Alan S. Potter, Geomax Professional Engineers, Inc.

and location, and created a relatively dangerous condition in the immediate vicinity of the main Dam. Post-flood analyses in 1996 revealed that floodwaters nearly over-topped the right bank of the river upstream of Wapato Dam and the WIP Main Canal. Had the Yakima River captured the WIP Main Canal, the effects of the flood would have extended further. Serious damage to croplands, passage corridors, and population centers would have undoubtedly occurred (Eco-Northwest 2001). Additionally, extreme scour along the sheet-piling cutoff wall across the mid-river island that separates the East and West Dams began to erode a pathway that would have enabled the Yakima River to carve a new channel that would largely bypass the two dam structures. This channel migration would likely have precipitated a financially and ecologically expensive flood fight. Post-flood repairs to WIP facilities would have been significantly more invasive and extensive. Presently, Wapato Dam is not protected from these same dangers should another large flood occur.

The inwater elements of the proposed action include constructing five rock drop structures both up- and downstream of Wapato Dam, and two rock barbs upstream of the Dam on the right bank of the Yakima River (Figure 2). Three mid-river island rock drop structures and two floodplain cross dikes along the margin of the right bank upstream of Wapato Dam will require no instream work. Additionally, the BIA will remove a large stockpile of bedload extracted from the Yakima River during past maintenance activities that is presently stored on the upstream point of the mid-river island. Since the stockpile is composed of clean alluvium, some or all of it may be used to fill the voids of the five instream drop structures. The Wapato Dam flood control project is scheduled to begin in the summer of 2003, pending approval and receipt of other needed permits. All inwater construction activities, regardless of the year in which they are performed, will take place between July 15 and September 30. Further descriptions of each of these elements of the proposed action are presented below.

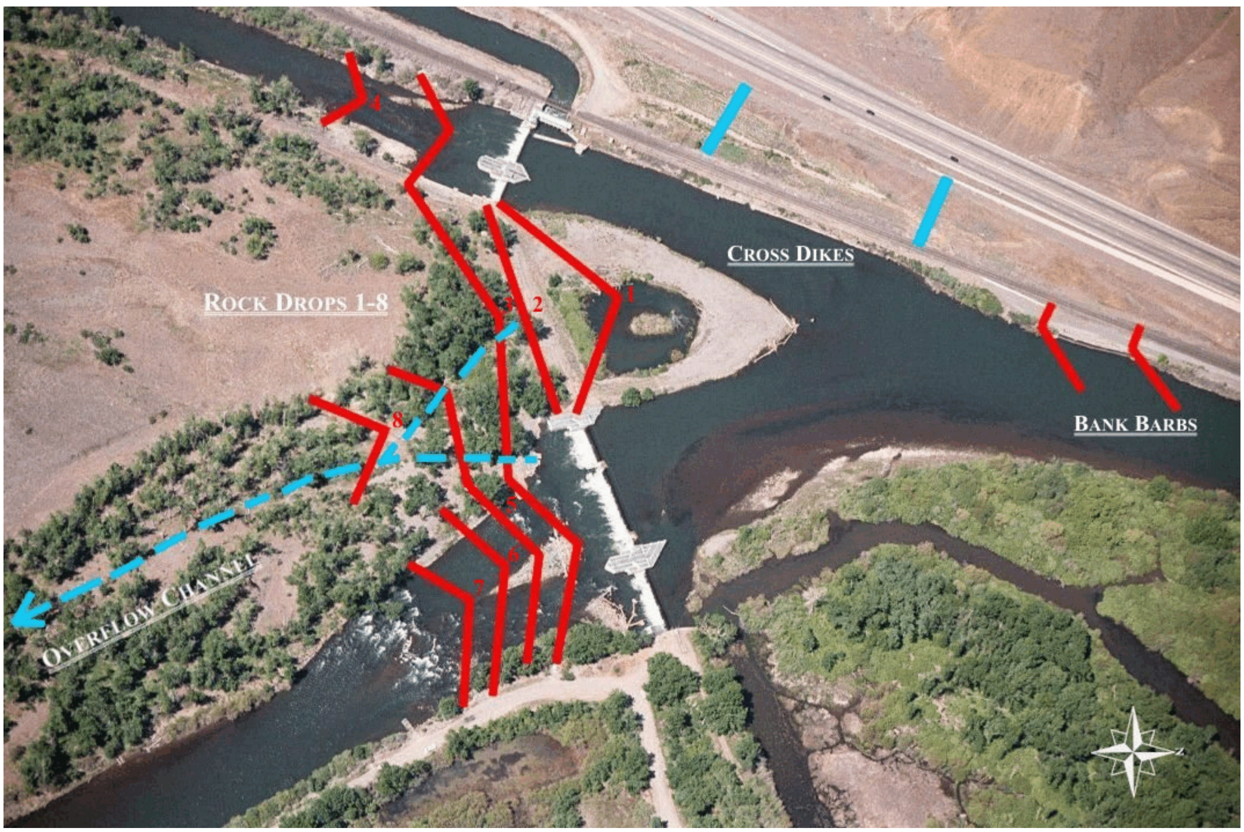

Figure 2. Annotated schematic representation of instream and floodplain structural elements of the Wapato Dam flood control project. Photo courtesy of Alan S. Potter, Geomax Professional Engineers, Inc.

1.3.1 Rock Drop Structures

The BIA will size, position, and construct eight rock drop structures that will help control the energy gradient of the Yakima River near Wapato Dam across a range of flows. These structures will create a stair-step profile that dissipates erosive energy and encourages the river to occupy floodplain area between the East and West Dams that is presently only covered during very high water events (Figure 2). These flood control measures are designed to help protect the integrity of Wapato Dam, manage bedload deposition, and encourage more normative interactions between the river and floodplain. All eight structures will work in concert, especially at higher flows as river discharge is directed down the center of the mid-river island, creating a spillway that encourages the Yakima River to access more of its historic floodplain while reducing a substantial amount of pressure on the East Dam, West Dam, and WIP headgate. Further, installing these drop structures will improve fish ladder hydraulic conditions because scour along the toe of each dam has dropped tailwater levels and altered the conditions under which the fishways were designed. The channel-spanning drops will raise the water-surface along the downstream face of each dam, provide better ladder entrance conditions, and equalize the elevation difference across each fish ladder, allowing them to operate within criteria over a wider range of flows than under present conditions.

The BIA will construct two drop structures in the Yakima River below the West Dam, and four in the river below the East Dam (Figure 2). However, two of these instream structures will actually be the "wings" of a large keystone member that originates on the far-right bank, spans both channels and the mid-river island, and terminates on the left bank of the channel below the East Dam. This large structure will function in concert with three structures (constructed in the dry) on the mid-river island to form a fail-safe spillway down the left margin of the island. Floodwaters will crest the upstream end of the mid-channel island, interact with grade-control structures, and flow into a well-developed historic channel on the mid-river island. This channel, once part of the Yakima River, is connected to the river at the downstream end and presently contains standing pools of water. When the proposed action is complete, the low-water surface elevation of the Yakima River below Wapato Dam (both East and West) will increase by approximately 3 feet. Raising the water surface elevation, in conjunction with the ability to regulate flow via a notch in grade control number three directly below the right bank fish ladder on the East Dam, will ensure at least 10 cubic feet per second (cfs) of perennial flow through the overflow channel. This design flow is intended to connect existing standing pools of water, promote the establishment of a perennial stream channel, and provide off-channel habitat for native and anadromous species assemblages. Further, the overflow channel will expand the active floodplain below Wapato Dam, and promote the regeneration of riparian vegetation.

All drop structures, whether instream or on the floodplain, will measure about 20 feet wide at the top and consist of very large rock. Seven out of 10 rocks in every structure will weigh from 2,500 to 11,500 pounds per rock, and the remainder will weigh from 100 to 2,500 pounds each. In total, upland drop structures will cover about 40,000 square feet of floodplain, and require approximately 3,650 cubic yards of rock. The five inwater drop structures will require roughly 6,400 cubic yards of rock covering approximately 34,000 square feet of the bed of the Yakima River. Large rock used for instream structures will be clean and free of fine sediments, and smaller cobbles and gravels will be used to help seal the interstitial spaces between large boulders (see Section 1.3.3). Low-flow boat notches in each inwater drop structure will ensure navigability. Additionally, the maximum difference in up- and downstream water surface elevation at each drop structure will be no greater than 18 inches, and should pose no passage problems for MCR steelhead or other native and anadromous fish.

Generally, the sequence of events for all inwater drop structures will proceed as follows. A thumbed excavator is used for minor shoreline excavation to form the key of each end of the drop. Drop structures then "grow" outward from these keys as large rock is placed, progressively extending the drop structure toward the center of the river. The excavator will travel into the river using the rock drop structure as a pad, minimizing additional streambed disturbance and helping compact the structure. Minor instream excavation will occur to seat large rocks in the riverbed, but excavated bed materials will be replaced into the void spaces of each rock drop; thus no net removal of benthic habitat will occur.

Where possible, heavy equipment will access instream structures and portions of channel-spanning structures from locations situated on the banks of the Yakima River. However, river crossings must occur to facilitate completion of all elements of the project. Channel adjustments below the East Dam have exposed bedrock about 400 feet downstream, and construction of a drop structure just upstream will provide a stable crossing area for large equipment (*e.g.,* excavators, haul trucks, and other earth-moving equipment) that must access the mid-river island. The BIA will replace all petroleum-based lubricants and hydraulic fluids in any vehicle that crosses or works in the Yakima River with non-toxic, biodegradable fluids. The proposed action includes the use of "off-road" haul trucks that have twice the payload of normal dump trucks, thus requiring half as many river crossings.

Placement and alignment of all drop structures, whether instream or on the floodplain, will capitalize on existing openings to minimize the destruction and/or removal of floodplain vegetation. However, a few mature adult cottonwoods and other native trees near the center of the mid-river island will likely be destroyed to facilitate drop placement. The BIA will incorporate any adult trees removed during the construction of floodplain rock structures into adjacent instream drops to help augment the supply of large woody debris (LWD) in the Yakima River. Disturbed areas with access to the water table and the keys of each drop structure will be revegetated with willow and/or dogwood cuttings. The BIA will plant rooted cottonwood stock in areas with an adequate hydroperiod at a ratio of ten new plants for every adult cottonwood tree destroyed. Disturbed areas with a more xeric soil moisture regime will be broadcast seeded with a native grass mix upon completion of construction activities.

1.3.2 Rock Bank Barbs

The right bank of the Yakima River approximately 1,100 feet upstream of Wapato Dam is armored with sheet-piling that was originally constructed to protect an adjacent railroad grade and highway, and deflect the river from an upstream historic channel directly aligned with the WIP Main Canal (see Figures 1 and 2). Recent high flow events have undermined this protective wall, damaged its structural integrity, and created the possibility of catastrophic channel relocation that could destroy important travel corridors and irrigation delivery conduits. To address this issue, the BIA proposes to construct two rock barbs in the right bank of the river;

one at either end of the piling wall, separated by approximately 150 feet. These barbs will act to turn flow away from the bank and piling wall, help control bed scour, and promote a depositional environment along the bank of the river by creating a velocity shadow both upstream and downstream of each barb. This depositional area will foster and protect the growth of riparian vegetation which will, in turn, contribute to the structural integrity of the sheet-pile wall. The two proposed barbs should provide better fish habitat than presently exists at the site by providing velocity refugia for adult and juvenile salmonids, as well as improving the lateral habitat diversity of the immediate area. Additionally, at higher discharge, these barbs will help divert overtopping flows away from the piling wall and the WIP Main Canal.

The BIA will key each bank barb into the existing streambank at either end of the sheet-pile wall, and construction equipment, methods, and sequencing will largely follow activities described in Section 1.3.1. Each barb will extend into the channel about 40 feet, measure about 30 feet wide at the bank, and taper to approximately 10 feet at the end. Barbs will consist of large rock weighing as much as five tons apiece, and both barbs will require approximately 300 to 400 cubic yards of material covering roughly 2,400 square feet of riverbed. In comparison to standard bank protection techniques (*i.e.*, tail-dumping large, angular basalt rip-rap) the installation of rock barbs is a more progressive methodology that promotes natural channel dynamics, provides better fish habitat, and encourages bank accretion and establishment of riparian vegetation. After construction, the keys of each barb will be planted with live willow stakes in an effort to provide better riparian habitat along a relatively barren reach of the Yakima River shoreline.

1.3.3 Cross Dikes

The BIA will construct two cross dikes in a narrow, low area bracketed by a railroad grade and the US Highway 97 road prism to reduce the potential for capture of the WIP Main Canal by floodwaters that overtop the railroad embankment (Figure 2). These cross dikes will help prevent high flows from concentrating in a low swale immediately upstream of the WIP Main Canal, cutting off a potential flow path with disastrous consequences. Each cross dike will be approximately 100 feet long and 40 feet wide, and require about 800 cubic yards of large rock and structural fill. The BIA will build each dike in the dry, and construction activities will require no equipment entry into or crossing of the Yakima River. Finally, these two cross dikes will be constructed on top of areas covered with largely nonnative vegetation, and will be broadcast seeded with a mixture of native grasses upon completion of construction activities. Additionally, the BIA will plant all disturbed equipment travel corridors and construction areas with native grass seed upon project termination.

1.3.4 Stockpiled Bedload Removal

Instream maintenance activities in past years have resulted in the removal of a considerable amount of large cobbles and gravels that are presently stockpiled and terra-formed at the head of the mid-river island that creates the East and West channels of the Yakima River (Figure 1). Bedload continues to accumulate above Wapato Dam, and stockpiled materials have been used to construct a barrier along the upstream margin of the island that attempts to force the Yakima River to flow around the island into the East and West channels. This barrier prevents high flows from spreading out over the island, and tends to concentrate energy at the East and West Dams. Under sustained flood conditions, this cobble and gravel berm has failed, and the Yakima River has washed over the upstream end of the island and attacked the sheet-pile wall that connects the East and West Dams. Past bedload management activities by the BIA on the upstream end of the mid-river island have resulted in sporadic, uneven, and unpredictable geomorphic adjustments during flood events that endanger Wapato Dam, and require substantial repairs that alter river and floodplain habitat.

The BIA proposes to remove approximately 2,000 cubic yards of stockpiled cobbles and gravels from the head end of the island to promote a more even and controlled overtopping of the mid-river island, and to allow the Yakima River access to downstream grade control structures (both instream and on the island). Removing stockpiled alluvium will occur entirely in the dry, and since the majority of the target material is clean cobbles and gravels, some or all of it will be used to fill void space during the construction of inwater rock drop structures. The BIA will destroy a minor amount of nonnative vegetation during this operation, and removing stockpiled bedload at the head of the island will drop the elevation of the floodplain and help promote natural interactions with the Yakima River. Further, this element of the proposed action will likely help provide a prime location for the future establishment of native riparian vegetation because it will help raise the water table across the floodplain and produce hydric growing conditions amenable to native floodplain plant species.

1.3.5 Future Rock Structure Maintenance

The BIA foresees the need for future maintenance activities to adjust, repair, and modify inwater and floodplain structures described in Sections 1.3.1 and 1.3.2, especially after the first major flood event. The flow path over the grade control structures at the center of the island is intended to relieve pressure on the concrete East and West Dams, and the rock structures may require minor reconstruction after a major flood. A benefit of using large rock in lieu of a rigid material like concrete for grade control structures is the ease with which individual rocks can later be rearranged and adjusted to ensure proper structural function–without major reconstruction. Maintenance activities will require heavy equipment to cross the Yakima River to allow access to island rock structures as well as structural keys along the banks of the island, and may include

- Adjustment, alterations, and repair of rock grade control structures,
- Adjustment of the overflow channel base flow notch in rock drop number three, and/or low flow notches in drop structures near the fish ladders in the East and West Dams,
- Gravel removal, done in the dry, from the head end of the mid-river island,
- Relocation of trees and other debris from rock structures that affects structural integrity and operation, navigability, and/or fish passage. Trees removed from rock structures will be relocated into the active channel below the downstream-most rock drop.

When the construction of drop structures on the mid-river island is complete, a stockpile of large rock will remain on the island in a location where floodwater will have limited access. To provide adequate time for a high flow event to occur, the BIA proposes a 10-year maintenance schedule consisting of the points outlined above. Heavy equipment will access the island via constructed drop structures, and only then from July 15 to September 30 of any given year. The BIA will steam-clean all equipment that will enter the Yakima River, and all hydraulic fluids will be replaced with non-toxic biodegradable liquids. At least two weeks prior to inwater maintenance activities, the BIA will notify NOAA Fisheries of the scope and magnitude of their intentions to ensure compliance with activities as described in this Opinion.

1.4 Description of the Action Area

Under the ESA, the "Action Area" is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area of the action (50 CFR 402.02 and 402.14(h)(2)). For the purposes of this consultation, the Action Area includes all aquatic habitat along the Yakima River from Union Gap at RM 106.8 downstream to Sunnyside Diversion Dam, located at RM 103.8.

2.0 ENDANGERED SPECIES ACT

2.1 Biological Opinion

The objective of this Opinion is to determine whether the proposed project is likely to jeopardize the continued existence of the MCR steelhead ESU.

2.1.1 Status of Species and Critical Habitat

The listing status, biological information, and Critical Habitat elements or potential Critical Habitat for the NOAA Fisheries listed species that are the subject of this consultation are described below in Table 1. Most of the information listed in the following table is available for download at http://www.nwr.noaa.gov/1salmon/salmesa/index.htm.

Species	Listing Status Reference	Critical Habitat Reference	Biological Information

MCR Steelhead (*O. mykiss*)	Threatened Species (64 FR 14517)	Not Designated[2]	Status Review of Steelhead from Washington, Idaho, Oregon and California, (Busby *et al.* 1996).

Table 1. References to NOAA Fisheries Status Review and Federal Register Notice containing additional information concerning listing status and biological information for Middle Columbia River steelhead.

Middle Columbia River steelhead, as well as other native fish stocks across the Columbia River Basin, have been negatively affected by a combination of habitat alteration and hatchery management practices. The four downstream, mainstem dams on the Columbia are perhaps the most significant source of habitat degradation for this ESU. The dams act as a partial barrier to passage, kill out-migrating smolts in their turbines, raise temperatures throughout the river system, and have created lentic refugia for salmonid predators. Additionally, profound alterations in the structure and function of riverine systems has provided conditions that impair the physiology of salmonids and invigorate native and nonnative predators, severely truncate or remove natural spatial and temporal discharge characteristics tied to life-history requirements, and often dictate the long-term timing of immigration and emigration. In addition to dams, irrigation systems have had a major negative impact by diverting large quantities of water, stranding and/or entraining fish, and acting as barriers to passage. Other major habitat degradation has occurred through urbanization (especially in alluvial floodplains) and livestock grazing practices (WDFW *et al.* 1993; Busby *et al.* 1996; 1999; NMFS 1996b; 63 FR 11798).

Habitat alterations and differential habitat availability (*e.g.*, daily or annually fluctuating discharge levels) limit the production of naturally spawning populations of salmon and steelhead. The National Research Council Committee on Protection and Management of Pacific Northwest Anadromous Salmonids identified habitat problems as a primary cause of declines in wild salmon runs (NRCC 1996). Some of the habitat impacts identified were the fragmentation and loss of available spawning and rearing habitat, migration delays, degradation of water quality, removal of riparian vegetation, decline of habitat complexity, alteration of streamflows and streambank and channel morphology, alteration of ambient stream water temperatures, sedimentation, and loss of spawning gravel, pool habitat and LWD (NMFS 1996a; 1998; NRCC 1996; Bishop and Morgan 1996).

Hatchery management practices are suspected to be a major factor in the decline of this ESU. The genetic contribution of non-indigenous, hatchery stocks may have reduced the fitness of the locally adapted native fish through hybridization and associated reductions in genetic variation or introduction of deleterious (non-adapted) genes. Hatchery fish can also directly displace natural spawning populations, compete for food resources, or engage in agonistic interactions

[2]Under development. On April 30, 2002, the U.S. District Court for the District of Columbia approved a NOAA Fisheries consent decree withdrawing a February 2000 critical habitat designation for this and 18 other ESUs.

(Campton and Johnston 1985; Waples 1991; Hilborn 1992; NMFS 1996a; 63 FR 11798).

Within the Yakima River Basin, adult steelhead returns have averaged 1,665 fish (range 505 (1996) to 4,491 (2002)) between 1985 and 2002 as monitored at Prosser Dam (RM 47.1; YSS 2001; 2001 and 2002 data from Yakima-Klickitat Fisheries Program (YKFP), available at: www.ykfp.org). The comparatively large return of MCR steelhead to the Yakima Basin in 2002 mirrors high numbers of returning salmon and steelhead observed across to the Columbia basin in the past two years.

Generally, adult MCR steelhead migration into the Yakima Basin peaks in late-October and again from late February or early March, concurrent with the spawning run (Figure 3). Steelhead adults begin passing Prosser Dam in late summer, suspend movement during the colder parts of December and January, and resume migration from February through June. The relative number and timing of wild adult steelhead returning during the fall and winter-spring migration periods varies from year to year, most likely because of a low-flow induced thermal barrier in the lower Yakima River in the fall (BOR 2000; YSS 2001). Most adult steelhead over-winter in the Yakima River between Prosser and Sunnyside Dams (RM 103.8) before moving upstream into tributary or mainstem spawning areas (Hockersmith *et al.* 1995). Steelhead spawning characteristics vary across temporal and spatial scales in the Yakima Basin, although the current spatial distribution is significantly decreased from historic conditions. Yakima Basin steelhead spawn in intermittent streams, mainstem and side-channel areas of larger rivers, and in perennial streams up to relatively steep gradients (Hockersmith *et al.* 1995; Pearsons *et al.* 1996). Hockersmith *et al*(1995) identified the following spawning populations within the Yakima Basin: upper Yakima River above Ellensburg, Teanaway River, Swauk Creek, Taneum Creek, Roza Canyon, mainstem Yakima River between the Naches River and Roza Dam, Little Naches River, Bumping River, Naches River, Rattlesnake Creek, Toppenish Creek, Marion Drain, and Satus Creek. Of 105 radio-tagged fish observed from 1990 to 1992, Hockersmith *et al*(1995) found that well over half of the spawning occurs in Satus and Toppenish Creeks (59%), with a smaller proportion in the Naches drainage (32%), and the remainder in the mainstem Yakima River below Wapato Dam (4%), mainstem Yakima River above Roza Dam (3%), and Marion Drain (2%), a WIP drain tributary to the Yakima River. Electrophoretic analyses have identified four genetically distinct spawning populations of wild steelhead in the Yakima Basin: the Naches, Satus, Toppenish, and Upper Yakima stocks (Phelps *et al*2000).

Typically, steelhead spawn earlier at lower, warmer elevations than higher, colder waters. Overall, most spawning is completed within the months of January through May (Hockersmith *et al*1995), although steelhead have been observed spawning in the Teanaway River (RM 176.1), a tributary to the Upper Yakima, into July (Todd Pearsons, Washington Department of Fisheries and Wildlife [WDFW], personal communication). These steelhead spawn later in the year at higher elevations in the Yakima Basin, and face lethal conditions (in most years) as down-migrating kelts (spawned-out adults returning to the ocean) in the lower Yakima River. Mid-Columbia River steelhead that spawn in the Yakima Basin at lower elevations potentially meet the same fate, however earlier spawn timing and emigration may provide increased survival because kelts traverse the lower Yakima River before water quality becomes lethal. High

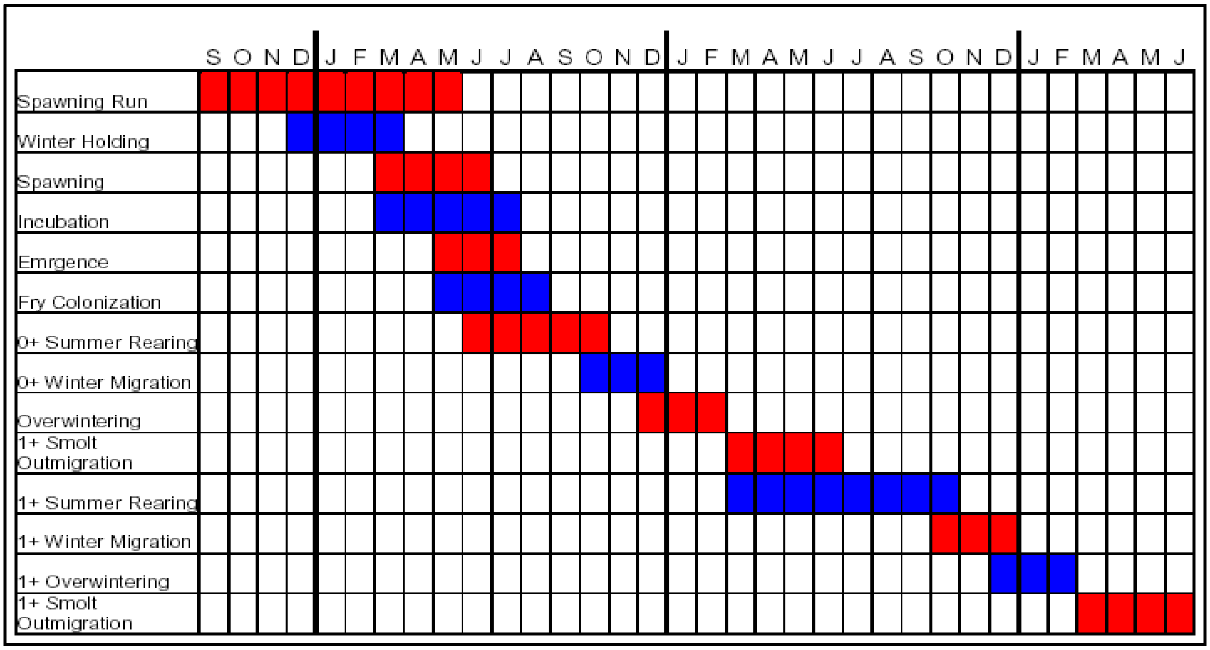

Figure 3. Generalized duration of successive life stages (excluding kelts) for all steelhead stocks in the Yakima River Basin (taken from YSS 2001, with permission).

temperatures, low flows, and degraded water quality from irrigation effluents (*i.e.*, high temperature, turbidity and pollutant concentrations), contribute to extremely low survival during summer months (Vaccaro 1986; Lichatowich and Mobrand 1995; Lichatowich *et al.* 1995; Pearsons *et al*. 1996; Lilga 1998). Steelhead kelts and smolts have been observed at the Chandler Juvenile Enumeration Facility (RM 47.1) into the middle of July, but operations at this facility cease around this time because most salmonids (including smolt, juvenile, and kelt MCR steelhead) observed are dead on arrival (J. Blodgett, Yakama Nation Fisheries Program, personal communication). Conditions in the lower Yakima River become suitable once again for salmonids in early fall, near the end of the irrigation season (YSS 2001).

Juvenile steelhead utilize tributary and mainstem reaches throughout the Yakima Basin as rearing habitat, until they begin to smolt and emigrate the basin. Smolt emigration begins in November, peaking between mid-April and May. Busack *et al*. (1991) analyzed scale samples from smolts and adult steelhead and found, generally, that smoltification occurs after two years in the Yakima system, with a few fish maturing after three years and an even smaller proportion reaching the smolt stage after one year. When compared to spawning distribution and run timing, these data suggest that various life stages of listed steelhead are present throughout the

Yakima Basin and its tributaries virtually every day of the year.

The Upper Yakima River steelhead population was undoubtedly adversely affected by operations at Roza Dam (RM 128) between 1939 and 1958 (BOR 2000). Although fitted with a ladder, the pool at Roza Dam was kept down from the end of one irrigation season (mid-October) to the beginning of the next (mid-March) for these 20 years. Hockersmith *et al.* (1995) found that steelhead passed Roza Dam from November through March, and more recent data suggest that passage occurs from the end of September through May (Mark Johnston, Yakama Nation Fisheries Program, personal communication). Consequently, operations at Roza Dam virtually eliminated fish passage for most of the steelhead migration season, and excluded most steelhead bound for the upper Yakima from reaching their destination. A new ladder was installed at Roza Dam in 1989 that allows better passage, but only when the pool is completely up or down. However, the ladder is inoperable at levels between maximum and minimum pool when the reservoir is manipulated to facilitate screen maintenance at the end of October and early November. Additionally, as previously described, MCR steelhead spawn and emergence timing is shifted to later in the year in the Upper Yakima, and emigrating smolts therefore meet hazardous if not lethal water quality conditions in the lower Yakima River. This combination of historic and contemporary seasonal factors could help explain the low abundance of MCR steelhead in the Upper Yakima basin.

Steelhead across the Yakima River Basin have faced a number of challenges in the recent past, but continue to endure although at significantly depressed population levels. The four genetically dissimilar stocks identified persist across widely varied conditions of streamflow, habitat, topography, elevation, and land management scenarios, in a fraction of their historic habitat.

2.1.2 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA and 50 CFR Part 402 (the consultation regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify Critical Habitat (where designated). This analysis involves the initial steps of (1) defining the biological requirements and current status of the listed species, and (2) evaluating the relevance of the environmental baseline to the species' current status.

From that, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of injury or mortality attributable to (1) collective effects of the proposed or continuing action, (2) the environmental baseline, and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages that occur beyond the Action Area. If NOAA Fisheries finds that the action is likely to jeopardize, NOAA Fisheries must identify reasonable and prudent alternatives for the action.

Guidance for making determinations on the issue of jeopardy and adverse habitat modifications are contained in *The Habitat Approach, Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Anadromous Salmonids*, August 1999 (available online at: http://www.nwr.noaa.gov/1habcon/habweb/pubs/newjeop9.pdf). For the proposed action, NOAA Fisheries' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. Additionally, NOAA Fisheries' jeopardy analysis considers the extent to which the proposed action impairs the function of habitat elements necessary for the migration, spawning, and rearing of listed salmonids under the existing environmental baseline.

2.1.2.1 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying ESA section 7(a)(2) to listed salmon is to define the species' biological requirements that are most relevant to each consultation. The most relevant biological requirements affected by the action under consultation include good water quality and unimpeded migratory (safe passage) conditions. NOAA Fisheries also considers the current status of the listed species; taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its original decision to list the species for protection under the ESA. Additionally, the assessment will consider any new information or data that are relevant to the determination (see Table 1 for references).

The relevant biological requirements are those necessary for salmon in each ESU to survive and recover to naturally reproducing population levels, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

The biological requirements of MCR steelhead include food, flowing water (quantity), high quality water (cool, free of pollutants, high dissolved oxygen concentrations, low sediment content, etc.), clean spawning substrate, and unimpeded migratory access to and from spawning and rearing areas (adapted from Spence *et al*. 1996). Even slight modifications of these habitat elements can produce deleterious effects to MCR steelhead and other native fishes.

NOAA Fisheries has related the biological requirements for listed salmonids to a number of habitat attributes, or pathways, in the Matrix of Pathways and Indicators ((MPI); available online at: http://www.nwr.noaa.gov/1habcon/habweb/pubs/matrix.pdf; NMFS 1996b). These pathways (Water Quality, Habitat Access, Habitat Elements, Channel Condition and Dynamics, Flow/Hydrology, and Watershed Conditions) indirectly measure the baseline biological health of listed salmon populations through the health of their habitat. Specifically, each pathway is made up of a series of individual indicators (*e.g.*, indicators for Water Quality including Temperature, Sediment/Turbidity, and Chemical Contamination/Nutrients) that are measured or described directly (see, NMFS 1996b). Based on the measurement or description, each indicator is classified within a category of the properly functioning condition (PFC) framework: (1) *properly functioning*, (2) *at risk*, or (3) *not properly functioning*. Properly functioning condition is defined as "the sustained presence of natural habitat forming processes in a watershed that are necessary for the long-term survival of the species through the full range of environmental variation." The biological requirements of MCR steelhead likely to be affected by the proposed action include water quality (*e.g.,* sediment/turbidity), habitat elements (*e.g.,* substrate, LWD, pol frequency and quality, off-channel habitat and refugia), channel condition and dynamics (*e.g.,* floodplain connectivity), and watershed conditions (*e.g.,* riparian reserves).

2.1.2.2 Factors Affecting the Species at the Population (ESU) Level

In other Biological Opinions, NOAA Fisheries assessed life history, habitat and hydrology, hatchery influence, and population trends in analyzing the effects of the underlying action on affected species at the population scale (see, for example, Reinitiation of Consultation on Operation of the Federal Columbia River Power System (FCRPS), including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation (BOR) Projects in the Columbia Basin, NMFS 2000.) A thumbnail description of each of these factors for the MCR steelhead ESU is provided below.

2.1.2.2.1 Life History

Most fish in this ESU smolt at 2 years and spend 1 to 2 years in salt water before reentering freshwater, where they may remain up to a year before spawning (Howell *et al.* 1985). All steelhead upstream of The Dalles Dam are summer-run (Schreck *et al.* 1986, Reisenbichler *et al.* 1992, Chapman *et al.* 1994). The Klickitat River, however, produces both summer and winter steelhead, and age-2-ocean steelhead dominate the summer steelhead, whereas most other rivers in the region produce about equal numbers of both age 1- and 2-ocean fish. A nonanadromous form co-occurs with the anadromous form in this ESU; information suggests that the two forms may not be isolated reproductively, except where barriers are involved.

2.1.2.2.2 Habitat and Hydrology

Substantial habitat blockages are present in this ESU. While Pelton Dam on the Deschutes River may represent one of the most significant, minor habitat blockages occur throughout the region. In the Yakima Basin, Cle Elum, Rimrock, and Bumping Dams are examples of storage projects that have blocked many miles of formerly utilized habitats since the early part of the Twentieth Century. Water withdrawals and overgrazing have seriously reduced summer flows in the principal summer steelhead spawning and rearing tributaries of the Deschutes River. This is significant because high summer and low winter water temperatures are limiting factors for salmonids in many streams in this region (Bottom *et al.* 1985).

2.1.2.2.3 Hatchery Influence

Continued increases in the proportion of stray steelhead in the Deschutes River basin is a major concern. The Oregon Department of Fish and Wildlife and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) estimate that 60% to 80% of the naturally spawning population consists of strays, which greatly outnumber naturally produced fish. Although the reproductive success of stray fish has not been evaluated, their numbers are so high that major genetic and ecological effects on natural populations are possible (Busby *et al.* 1999).

The negative effects of any interbreeding between stray and native steelhead will be exacerbated if the stray steelhead originated in geographically distant river basins, especially if the river basins are in different ESUs. The populations of steelhead in the Deschutes River basin include the following:

- Steelhead native to the Deschutes River
- Hatchery steelhead from the Round Butte Hatchery on the Deschutes River
- Wild steelhead strays from other rivers in the Columbia River basin
- Hatchery steelhead strays from other Columbia River basin streams

Regarding the latter, CTWSRO reports preliminary findings from a tagging study by T. Bjornn and M. Jepson (University of Idaho) and NOAA Fisheries suggesting that a large fraction of the steelhead passing through Columbia River dams (*e.g.*, John Day and Lower Granite dams) have entered the Deschutes River and then returned to the mainstem Columbia River. A key unresolved question about the large number of strays in the Deschutes basin is how many stray fish remain in the basin and spawn naturally.

2.1.2.2.4 Population Trends and Risks

For the MCR steelhead ESU as a whole, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period[3] ranges from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (McClure *et al.* 2001). NOAA Fisheries has also estimated the risk of absolute extinction for four of the spawning aggregations, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (*i.e.,* hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the Yakima River summer run to 1.00 for the Umatilla River and Deschutes River summer runs (McClure *et al.* 2001). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years ranges from zero for the Yakima River summer run to 1.00 for the Deschutes River summer run (McClure *et al.* 2001). However, with respect to the Yakima River extinction risk, the estimates are extremely optimistic because of the nature of the source data and sparse information on hatchery fish (Michelle McClure, NOAA Fisheries Northwest Fisheries Science Center, personal communication).

[3]Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period that varies between spawning aggregations. Population trends are projected under the assumption that all conditions will stay the same into the future.

2.1.2.3 Factors Affecting the Species within the Action Area

Section 4(a)(1) of the ESA and NOAA Fisheries' listing regulations (50 CFR 424) set forth procedures for listing species. The Secretary of Commerce must determine, through the regulatory process, if a species is endangered or threatened based upon any one or a combination of the following factors; (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors affecting its continued existence.

The proposed action includes activities that will have some level of effects with short-term impacts from category (1) in the above paragraph, and the potential for long-term impacts as described in category (5). The characterization of these effects and a conclusion relating the effects to the continued existence of MCR steelhead is provided below, in Section 2.1.3.

The major factors affecting MCR steelhead within the Action Area include instream flows, channel conditions and dynamics, and riparian habitat. NOAA Fisheries uses the MPI to analyze and describe the effects of these factors on listed steelhead. As described above, the MPI relates the biological requirements of listed species to a suite of habitat variables. In the MPI analysis presented here, each factor is considered in terms of its effect on relevant pathways and associated indicators (*properly functioning, at risk, or not properly functioning*).

2.1.2.3.1 Instream Flows

Instream flows in the Yakima River within the Action Area are mostly derived from natural watershed processes (snowmelt runoff and rain-on-snow events), but the timing, magnitude, and duration of streamflow is significantly influenced by the operation of five upstream BOR storage reservoirs (*e.g.*, Keechelus, Kachess, Cle Elum, Rimrock and Bumping Dams). In an unregulated condition, the Yakima River would exhibit the hydrograph of a snowmelt-dominated system where discharge peaked in May concurrent with melting snow, and reached baseflow in late July. Discharge would have increased in early winter, as precipitation in the form of rainfall (and early snowmelt, to some degree) augmented summer baseflow (Parker and Storey 1916; Kinnison and Sceva 1963). Under these conditions, river ecosystems experienced a range of flows that served to promote floodplain riparian ecosystems, provide habitat for aquatic species assemblages, and protect vital ecosystem linkages and channel structure (Leopold *et al.* 1964; Ward and Stanford 1995a; 1995b; Fisher *et al.* 1998). Accordingly, aquatic biota have, over the eons, evolved life-history strategies that are spatially and temporally synchronized to seasonal runoff patterns (Groot *et al.* 1995; Stanford *et al.* 1996).

Presently, however, the Yakima River is manipulated to maximize winter reservoir storage and summer irrigation deliveries that are synchronized with the seasonal needs of irrigators. However, in most cases, reservoir operations produce streamflows across the basin that are asynchronous with the life-history requirements of aquatic species assemblages. Large volumes of water are released into the Yakima River throughout the summer months (irrigation season), peaking in mid to late August. Streamflows well in excess of estimated unregulated discharge persists throughout the Action Area until the end of the irrigation season, usually around mid-October. Additionally, summer streamflows can fluctuate wildly through the Action Area because of upstream diversions and operations, producing a dead zone along the shoreline of the river and in many backwaters. While fish are found in these areas, habitat quality is substantially reduced owing to baseflow instability and repeated expansion and contraction of the varial zone (Weisberg *et al.* 1990; Stanford 1994). Many aquatic populations living in these environments suffer high mortality rates from physiological stress, from wash-out during high flows, and from stranding during rapid dewatering (Cushman 1985, Petts 1984). During the late fall and throughout the winter, streamflow in the Action Area can be depleted as upstream reservoirs fill, and spate-induced flow spikes can be truncated. Additionally, alteration of the natural hydrograph has altered sediment transport relationships important to channel morphology and salmonid ecology.

Reservoir and diversion operations in the Upper Yakima Basin and Action Area have inverted and truncated the natural hydrograph, produced river systems that are spatially and temporally discordant with their surrounding watersheds, and negatively affected instream flows in the Action Area. The biota of these systems have suffered accordingly because flow regulation patterns are, at best, suboptimal for adult and juvenile steelhead (Fast *et al.* 1991; Stanford *et al.* 2002). Indeed, flow regimes that deviate from the natural condition are well understood to produce a diverse array of negative ecological consequences (Hill *et al.* 1991; Ligon *et al.* 1995; Richter *et al.* 1996; Stanford *et al.* 1996). In the MPI analysis, instream flows fall under the Flow/Hydrology pathway, and Change in Peak/Base flow indicator. Currently, for the reasons described above, this indicator is *not properly functioning*. In this instance, *not properly functioning* is defined as "pronounced changes in peak flow, base flow and/or flow timing relative to an undisturbed watershed of similar size, geology, and geography."

2.1.2.3.2 Riparian Habitat

Forest practices, agriculture, urbanization, and floodplain revetments have adversely affected riparian habitat throughout the Yakima River Basin. In the Action Area of this project, numerous anthropogenic features or activities (*e.g.*, Wapato Dam, WIP Main Canal, US Highway 97, Interstate Highway 82, Burlington-Northern Railroad, gravel pits, levees, local roads, irrigated agriculture, and urban development) have become permanent fixtures on the landscape and have displaced and altered native riparian habitat to some degree. Consequently, the potential for normal riparian processes (*e.g.*, shading, bank stabilization and LWD recruitment) to occur is diminished, and aquatic habitat has become simplified (Ralph *et al.* 1994; Young *et al.* 1994; Fausch *et al.* 1994; Dykaar and Wigington 2000).

The Yakima River reach throughout most of the Action Area has extremely degraded riparian habitat primarily because of a long history of human development and construction activities. Road and railway prisms bracket the river, gravel resources have been mined right up to the river bank, and orchards and other crops are farmed up to the river's edge as well. Because of substantial development and the existence of vital public and Federal waterworks in the Action

Area, the Yakima River has been armored and channelized to convey large quantities of water and protect local infrastructure. Presently, floodplain revetments and management scenarios serve to limit interaction between the Yakima River and its floodplain, and severely impact native riparian habitat. Additionally, flow management scenarios (refer to Section 2.1.2.3.1) have further diminished physical processes that promote regeneration and growth of native riparian vegetation, often promoting the growth of nonnative plant species.

In the MPI analysis, activities that directly alter or prevent conditions that foster the growth and development of riparian vegetation affect several pathways and indicators. The Watershed Conditions pathway and Riparian Reserves indicator is *not properly functioning* in the Action Area: the riparian reserve system is fragmented, poorly connected, and provides inadequate protection of habitats and refugia for sensitive aquatic species (less than 70% intact). Additionally, the Water Quality and Habitat Elements pathways are also functioning *at risk* (Temperature indicator), or *not properly functioning* (LWD indicator) because of impaired riparian function.

2.1.2.3.3 Channel Condition and Dynamics

Alluvial channel patterns adjust by lateral planform migration and longitudinal profile changes through aggradation and degradation (Leopold *et al.* 1964; Dunne and Leopold 1978; Alabyan and Chalov 1998). Accordingly, rivers have a natural tendency to respond to flood events by occupying floodplain distributary channels, dissipating excessive erosive energy, rebuilding floodplain habitats, and recharging the shallow alluvial aquifer. The Action Area of this project contains relict braided, alluvial floodplain reaches that have been shown to be centers of riverine biological production and ecological diversity (Stanford and Ward 1988; Stanford *et al.* 1994; 1996; Stanford *et al.* 2002).

Numerous anthropogenic influences in the Action Area have altered the structure, function, and interaction of the Yakima River and its adjacent floodplain ecosystem. Flow regulation, gravel mining, diking, dams, floodplain revetments, armored channels, and highway and railroad construction have isolated or destroyed side channels and sloughs important to the ecology of salmonids and other native aquatic species assemblages. This combination of flow regulation, floodplain revetments and human activities has significantly inhibited the exchange of hyporheic waters, isolated and truncated hyporheic habitats, and simplified salmonid and macroinvertebrate habitats. Additionally, floodplain anthropogenic activities, in combination with surface-water management scenarios, have altered the timing and magnitude of natural exchange processes between surface water and the shallow alluvial aquifer of glacial deposits underlying the Yakima River throughout the Action Area.

Floodplain revetments were undertaken to protect the local infrastructure, and irrigated agriculture relies on intensive land and water management. However, these floodplain activities also had a negative impact on fisheries resources through simplifying and homogenizing littoral and riverine habitat, disconnecting the Yakima River from its floodplain, reducing channel complexity, and altering the flow regime under which aquatic species and riparian vegetation evolved (Dykaar and Wigington 2000). As a result, in the Yakima River throughout the Action Area, the Floodplain Connectivity and Width/Depth Ratio indicators (Channel Condition and Dynamics pathway) are *not properly functioning*. In this instance, *not properly functioning* is defined as "severe reduction in hydrologic connectivity between off-channel, wetland, floodplain and riparian areas; wetland extent drastically reduced and riparian vegetation/succession altered significantly." Additionally, the Off-channel Habitat indicator (Habitat Elements pathway) is *not properly functioning*, because "few or no backwaters, off-channel ponds, or low energy off-channel areas" currently exist, and the Substrate indicator (Habitat Elements pathway) is *not properly functioning* because "bedrock, and embedded cobbles and gravels dominate" throughout the Action Area.

2.1.2.4 Environmental Baseline

The environmental baseline represents the current basal set of conditions to which the effects of the proposed action would be added. The term "environmental baseline" means "the past and present impacts of all Federal, state, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process " (50 CFR 402.02). As described above in Section 1.4, the Action Area includes all aquatic habitat along the Yakima River from Union Gap at RM 106.8 downstream to Sunnyside Diversion Dam, located at RM 103.8.

The headwaters of the Yakima River (fifth order) emerge from the crest of the Cascade Mountains above Keechelus Lake. From there, the Yakima River flows approximately 215 miles downstream to Richland, Washington where it enters the Columbia River at RM 335.2. Total Yakima River drainage basin area is roughly 6,155 square miles, encompassing over 1,900 miles of perennial streams. No tributaries enter the Yakima River within the Action Area, however, major upstream systems include the Cle Elum and Teanaway Rivers in the upper basin, and the Naches River and Ahtanum Creek in the middle part of the basin. Below the Action Area, Ahtanum, Toppenish, and Satus Creeks are the largest natural tributaries entering the Yakima River.

The Yakima basin occupies two physiographic provinces (the Columbia Plateau and Cascade Mountains), and three major ecoregions (Cascades, Eastern Cascades Slopes and Foothills and Columbia Basin (Omernik 1987)). Consequently, climate, topography, precipitation, and vegetative cover are highly variable. In addition, the distribution and type of aquatic and terrestrial habitat is quite variable, supporting a wide range of species. With respect to anadromous fishery resources, the Yakima Basin once supported abundant and diverse runs of salmon and steelhead that now return in just a fraction of their historic numbers (Nehlsen *et al.* 1991; Tuck 1995; Busby *et al.* 1996; NMFS 1996).

At the downstream end of the Action Area, the Yakima River drains approximately 3,660 square miles of a mixture of landforms and vegetative ecotypes typified by the forested, mountainous terrain of the Cascades, and the dry, shrub-steppe hills of the Columbia Plateau and Eastern Cascade Slopes. In the Cascades ecoregion of the watershed, the Yakima River and its tributaries drain predominately forested, mountainous terrain populated by Pacific silver fir, larch, western hemlock, western red cedar, Douglas fir, lodgepole and white pine. At lower elevations in the Cascades and Eastern Cascades ecoregions, the slopes and foothills of the basin are populated by sparse stands of ponderosa pine, deciduous shrubs, and bunch grasses. The arid Columbia River ecoregion is dominated by shrub-steppe vegetation characterized primarily by sagebrush and dryland bunchgrasses. Riparian species change with elevation and precipitation, and include cottonwood, Douglas fir, western hemlock, red cedar, alder, and willow. Wetland areas are vegetated by sedges, rushes, and mannagrass; scrub-shrub wetlands support willow, alder, and/or spirea while marsh areas exhibit cattails and bulrushes.

Average gradient for the Yakima River through the Action Area is approximately 0.25%. River and floodplain morphology is largely composed of single-thread and braided channels that occupy alluvial floodplains of glacial origin (*e.g.*, outwash material). Anticlinal bedrock outcrops (*e.g.*, Union Gap) and floodplain revetments largely control the vertical and horizontal vertical positions of Yakima River. Anthropogenic activities in the floodplain of the Yakima River, including railway and highway construction, have leveed, armored, realigned, and shortened the historic channel, severely diminishing natural river-floodplain interactions. The primary land use in the area is irrigated agriculture, gravel mining, and transportation infrastructure. Secondary land uses include recreation and grazing.

Water quality in the Action Area can be poor because of irrigation effluents that enter the Yakima River upstream. However, inordinately high summer flows pursuant to the delivery of large amounts of water to the WIP Main Canal and Sunnyside Canal about 3 miles downstream may help to attenuate adverse water quality impacts at certain times of the year. In most years, beginning below the WIP Main Canal, irrigation diversions diminish streamflow and contribute to high temperatures that can impact native fish populations and produce instream conditions that invigorate nonnative predators. These adverse conditions are further punctuated by diversions into the Sunnyside Canal downstream of the Action Area. Additionally, runoff and/or groundwater recharge from downstream gravel pits on the right bank of the Yakima River within the Action Area may contribute warm water containing toxic constituents. Further, land-use activities (roading, grazing, farming, and gravel mining) have altered sediment cycling and nutrient delivery pathways, contributing to a riverscape that differs, often significantly, from its undeveloped template condition.

Threatened MCR steelhead are currently affected by a number of habitat modifications within the Action Area. The most prominent and deleterious modifications are the result of flow regulation and irrigation activities, as well as development in floodplain, riparian, and upland areas. Specifically, irrigation and development have had the following effects on the environmental baseline: (1) adversely affected instream flows, (2) degraded floodplain and streambank morphology and function, and (3) detached portions of the Yakima River and its tributaries from their historical floodplains creating impaired floodplain function.

Instream flow related BOR Yakima Project operations, pursuant to delivery of irrigation demands, have greatly impacted biotic and abiotic conditions in the Yakima River in the Action Area. Generally, instream flow problems stem from chronically low discharge levels during reservoir refill periods to inordinately high flows out of phase with the ecology of MCR steelhead when downstream demands are being met. Although these problems are more pronounced as one moves in the upstream direction in Yakima Basin, the hydrograph of the Yakima River in the Action Area exhibits diminished precipitation-induced late fall and winter spates, truncated spring runoff peakflows, and unnaturally high late spring and summer flows. High discharge levels during the summer months can produce rearing conditions that are energetically stressful to juvenile fish, stunting their growth and maturity to smoltification. Hydrograph simplification (*e.g.*, the removal of fall-winter flow spikes, attenuation of peakflows, and stable, high, irrigation flows), as well as flow regulation regimes that are asynchronous with the life-history requirements of native floodplain and aquatic species, has deleteriously altered MCR steelhead habitat throughout the Action Area.

Floodplain development and revetments, agricultural diversion structures, floodplain roads, armored streambanks, and floodplain gravel mines throughout the Yakima River Basin and Action Area has altered natural processes that served to (1) promote exchange of water and sediments between the rivers and their overbank habitats, (2) provide lateral habitat heterogeneity for MCR steelhead, and (3) maintain riparian habitat communities dependent on natural streamflow dynamics. As described in the preceding paragraph, flow management scenarios have served to exacerbate floodplain function problems.

Throughout the Action Area, riparian habitat has been degraded through a variety of activities. Among them, roading, farming, channel armoring, grazing, urban development, and floodplain revetments have had the greatest effect. These activities have degraded riparian habitat by direct canopy removal, covering the ground with materials that preclude plant growth, reducing the widths of riparian zones, and altering the riparian species composition in favor of nonnative plants. For MCR steelhead, the lack of properly functioning riparian habitat contributes to instream temperatures that may seasonally exceed physiological tolerances and streambank erosion that increases sedimentation of spawning habitat. Additionally, degraded riparian zones contribute an inadequate amount of LWD, and subsequently prevent or inhibit habitat forming processes such as pool formation and the establishment of instream cover. Although the Yakima River in the Action Area exhibits a tiny area of intact floodplain riparian habitats, flow management practices and floodplain infrastructure provide discharge out of phase with the natural hydrograph that is spatially and temporally incompatible with salmonid, riparian, and hyporheic species' requirements.

2.1.3 Effects of the Proposed Action

NOAA Fisheries' ESA implementing regulations define "effects of the action" as "the direct and indirect effects of an action on the species, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline." Direct effects are immediate effects of the project on the species or its habitat, and indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur (50 CFR 402.02).

2.1.3.1 Direct Effects

Direct effects result from the agency action and may include the effects of interrelated and interdependent actions. Future Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not evaluated. The direct effects resulting from the proposed Wapato Dam flood control project include (1) possible increase in turbidity pursuant to construction and maintenance activities, (2) disturbance of the streambed and banks during construction and maintenance, and (3) alteration of the geomorphic floodplain of the Yakima River.

2.1.3.1.1 Turbidity

Instream excavation, bank excavation, rock placement, and other activities associated with the installation of rock barbs and drop structures in the Yakima River will mobilize sediments and temporarily increase downstream turbidity levels. In the immediate vicinity of the construction activities (several hundred feet), the level of turbidity will likely exceed natural background levels by a significant margin and potentially affect listed MCR steelhead.

For salmonids, turbidity has been linked to a number of behavioral and physiological responses (*i.e.,* gill flaring, coughing, avoidance, increase in blood sugar levels) which indicate some level of stress (Bisson and Bilby 1982; Sigler *et al.* 1984; Berg and Northcote 1985; Servizi and Martens 1992). The magnitude of these stress responses is generally higher when turbidity is increased and particle size decreased (Bisson and Bilby 1982; Servizi and Martens 1987; Gregory and Northcote 1993). Although turbidity may cause stress, Gregory and Northcote (1993) have shown that moderate levels of turbidity accelerate foraging rates among juvenile chinook salmon, likely because of reduced vulnerability to predators (camouflaging effect).

When the particles causing turbidity settle out of the water column, they contribute to sediment on the riverbed (sedimentation). When sedimentation occurs, salmonids may be negatively affected: (1) buried salmonid eggs may be smothered and suffocated, (2) prey habitat may be displaced, and (3) future spawning habitat may be displaced (Spence *et al.* 1996). Additionally, turbidity and subsequent sedimentation can affect the quality of stream substratum as spawning material, influence the exchange of streamflow and shallow alluvial groundwater, occupy channel storage areas for cobbles and gravels, increase width-depth ratios, depress riverine productivity, and contribute to decreased salmonid growth rates (Waters 1995; Newcombe and Jensen 1996; Shaw and Richardson 2001).

The Wapato Dam flood control project will cause elevated turbidity levels during the instream construction period and for several days afterwards. River bank excavation for structure keys, as well as instream work to construct bank barbs and drop structures, will cause a temporary spike of sediment influx above background levels only moderate in magnitude. However, the effects of this turbidity on listed fish will be minimized by (1) excavating for the two rock barbs in a river bank largely composed of large rock that is low in fine sediment concentration, (2) excavating rock drop structure keys by beginning behind (*i.e.*, away from the stream channel) the existing bank and progressing waterward, (3) minimizing bed excavation for rock barbs and drop structures (as is currently proposed), (4) limiting in-water entry by large equipment, minimizing equipment crossings, and crossing only on newly-constructed structures, (5) using off-road haul trucks with 25-ton capacities to transport rock across to the mid-river island, and (6) performing in-water construction activities at a time when MCR steelhead are unlikely to be in the Action Area (July 15 to September 30), or present in very low numbers.

Further, it is also expected that listed fish present during the initial phases of construction will temporarily move to refuges where turbidity can be avoided, thus preventing injury or death. Additionally, the project work window will capitalize on a time of the year when spawning MCR steelhead or redds are not present, and adult fish (*e.g.*, adults and kelts) are most likely migrating in small numbers. Because the proposed drop structures and barbs are designed to stabilize the streambank, promote more normative floodplain interactions, and retain sediments, it is unlikely that they will cause long-term sedimentation problems in the Action Area. Instead, the rock drops and barbs are likely to reduce baseline erosion rates and decrease associated turbidity and sedimentation in the future.

Future maintenance activities to repair, reposition, and adjust rock drop structures are expected to produce discountable and insignificant turbidity levels, both in the short- and long-term. Limited equipment will be required, and machinery will access the center island by crossing one of the rock drop structures constructed as an element of the action under consultation. Instream work will not entail new constructions, only repositioning or repairing existing structures using existing instream rock. The majority of the other future maintenance activities proposed by the BIA include actions taken in the dry, thus obviating any turbidity and/or sedimentation concerns.

It is expected that turbidity and sedimentation caused by the action under consultation will be short lived, returning to baseline levels soon after construction is over, and long term impacts (*i.e.*, adverse modification of critical habitat) will not occur. Other than the short-term inputs mentioned above, this project will not change or add to the existing baseline turbidity or sedimentation levels within the Action Area. It is possible that the collection of rock structures in the active channel of the Yakima River and the mid-river island will serve to slightly improve long-term sedimentation (Water Quality Pathway) conditions by promoting streambed and floodplain dynamics that approach a more natural condition than is presently occurring. Allowing the Yakima River access to the mid-river island during high flows could help attenuate future sediment problems by increasing channel sediment storage areas, as well as fostering the growth and development of native riparian vegetation. Increased riparian vegetation growth on the mid-river island, now largely a barren moonscape of large cobbles and gravels, will likely contribute to channel roughness that encourages the future accretion of water-borne sediments and promotes additional riparian growth.

2.1.3.1.2 Streambed and Bank Disturbance

The construction elements of the action under consultation will disturb existing substrate, and require varying amounts of bank disturbance. The primary mechanisms of disturbance will be rock placement, instream excavation, bank excavation for key placement, tracked vehicle movement, and floodplain perturbations by machine travel and structure construction.

As previously stated, herbaceous and woody material will be removed to facilitate construction of the rock drop structures, barbs, and cross dikes. Although rock structures will be placed to minimize vegetation destruction, adult cottonwood trees on the mid-river island may be destroyed. Grown trees that are removed will be incorporated into the mid-channel and/or lateral margin areas of nearby drop structures, and replaced with rooted cottonwood stock at a ratio of ten to one. The addition of LWD into rock structures in either channel of the Yakima River throughout the Action Area will help provide better habitat for the assemblage of aquatic species. Barb construction will disturb armored banks composed of large rock, steel sheet-piling, and sparse nonnative vegetation. Construction of the two cross dikes will destroy areas vegetated with early seral native and nonnative vegetation that have not been recently inundated by floodwaters. However, post-construction revegetation work will provide an overall net gain in riparian vegetation within the project area. Additionally, the creation of a depositional environment by barb construction upstream and downstream of the steel sheet-piling wall will further promote the establishment and maintenance of riparian vegetation.

MCR steelhead might experience the effects of streambed disturbance to a minor extent. During the project work window, MCR steelhead life stages in the project area include a small number of juvenile and young-of-the-year (YOY) fish that are free-swimming in the water column and are therefore able to evacuate the area when disturbance is initiated. Therefore, the likelihood of mechanical injury by inwater machinery activity is very small. The most significant impact would be the temporary loss (burial or displacement) of some potential prey species (invertebrates) and their habitat, resulting from the placement of instream rock structures that will displace approximately 36,400 square feet of benthic habitat.

Invertebrates (*e.g.*, larval insects, obligate aquatic insects, molluscs, crustaceans etc.) recolonize disturbed areas by drifting, crawling, swimming, or flying in from adjacent areas (Mackay 1992). The time required for new invertebrates to reach pre-disturbance abundance levels and equilibrium would be related to the spatial scale of their initial habitat loss, the persistence of the excluding or disturbing mechanism, the size of adjacent or remnant invertebrate populations (potential colonizers), the season in which the disturbance is taking place, and the life history characteristics of the invertebrate species (Mackay 1992).

Lost foraging opportunities resulting from the disturbance of Yakima River bedforms will likely be short-lived as invertebrates will recolonize the disturbed substrate (Allan 1995). Long-term impacts to prey abundance and habitat are not predicted because (1) limited streambed excavation is required, (2) the summer-fall work window coincides with high levels of invertebrate activity (and therefore recolonization potential), and (3) following construction, new riverbed materials will resemble pre-disturbance habitat (*i.e.*, benthic habitat will not be permanently displaced). The addition of rock drop and barb structures to the action area should serve to improve the functional quality of the LWD and Substrate indicators (Habitat Elements pathway) by adding woody material to a relatively barren channel, and introducing a mixture of bedforms that provides more heterogeneous habitat for juvenile and young-of-the-year MCR steelhead. Finally, the rock structures should not reduce the long-term functional quality of juvenile foraging habitat in the Action Area.

2.1.3.1.3 Channel and Floodplain Alteration

The instream and floodplain construction elements Wapato Dam flood control project will alter fluvial geomorphic interactions in the Yakima River. Riverine structure and function are determined by the changing temporal interaction of the physical, chemical, and biological components of a river, along three physical dimensions: longitudinal (headwaters to downstream), vertical (water circulation into bed sediments of the channel and floodplain), and horizontal (water circulation onto and from floodplains) (Hynes 1983; Ward and Stanford 1995b). Floodplains, their riparian wetlands, and interconnected mosaics of aquatic and semi-aquatic habitats are integral components of rivers (Stanford and Gonser 1998), and are vital to the species that depend upon them for survival (Minshall *et al.* 1985; Stanford *et al.* 1996). Disconnecting river channels from their floodplain habitats by flow regulation and/or revetment can compromise the ecological integrity of riverine ecosystems (Sedell *et al.* 1990; Stanford and Hauer 1992; Ward and Stanford 1995a). Altering the runoff regime or channel hydraulics under which streams developed can produce channel forms that are dissimilar to the natural condition (Leopold *et al.* 1964), which can have corresponding detrimental effects to the organisms that coevolved within the same river system (Vannote *et al.* 1980; Wallace *et al.* 1982; Minshall *et al.* 1983). As described in Section 2.1.2.3.3, human activities, structural emplacements, and flow regulation scenarios have impaired interactions between the Yakima River and its floodplain in the Action Area.

The floodplain and channel-spanning instream rock drop structures in the Yakima River and on the mid-river island between the East and West dams will immediately alter the interaction between the river and its floodplain. The tailwater pool below the East Dam is approximately two feet lower than the pool below the West Dam. The East Channel has eroded down to bedrock about 400 feet downstream of the dam, producing a relative steep gradient in a short reach of the river that efficiently transports bedload and has produced an uneven energy gradient across the floodplain between the two river channels. Rock drop structures will immediately "pick up" the water surface elevation in the tailwater of both dams by approximately three feet, thus providing better passage conditions at all three fish ladders. The collection of inwater drop structures below Wapato Dam will raise the water table across the floodplain, and inundate more native riparian habitat than under present conditions. Additionally, the hydroperiod will change for near-bank riparian plants, creating conditions that favor native species over nonnative invaders.

The construction of a rock notch into drop structure number three immediately below and adjacent to the right fish ladder in the East Dam will provide a hydraulic control through which approximately 10 cfs will flow into the overflow channel on the mid-river island. The downstream end of the overflow channel is presently composed of standing pools that track the water surface elevation of the adjacent Yakima River. This channel is primarily fed by groundwater, and flows intermittently along its entire length during spring runoff and elevated discharge events. The upstream half of the overflow channel is disconnected from the Yakima River during the summer irrigation season, and receives no groundwater recharge because the adjacent river channel is downcut (Figures 1 and 2). The Wapato Dam flood control project will provide perennial flow to an existing channel that will be connected to the Yakima River year-round. This perennial channel will be approximately 3,000 feet long, and will provide an immediate refuge from high flows for native salmonids. Further, over time, the overflow channel will display the structure and function of a distributary channel of the Yakima River, complete with intact riparian vegetation and preferential thermal and hydraulic conditions for native aquatic species assemblages. The long-term effects of floodplain and instream structures on the Yakima River in the Action Area will be discussed later in Section 2.1.3.2.

The channel-spanning rock drop structures will immediately begin to capture and store available sediment moving through the river system. The effect of this mechanism will be most pointed in the East Channel, which is presently eroded to bedrock and exhibits relatively homogeneous bed composition and channel structure. Additionally, the combination of grade control structures in both channels will begin to redistribute bedload as scour pools form along the downstream center of each rock drop, and cobbles and gravels are subsequently deposited on the upstream side of the next downstream structure. Over time, increased substrate heterogeneity will provide improved rearing habitat for salmonids and other native fishes, and promote a more natural assemblage of benthic invertebrates. Scour pools will provide holding habitat for adult salmon and steelhead, rearing habitat for juvenile salmonids, and increased vertical and lateral channel heterogeneity for the entire aquatic species assemblage of the Action Area.

The two rock barbs proposed for installation adjacent to the sheet-pile wall in the right bank of the Yakima River are intended to turn the river away from the streambank, and promote a depositional environment that will protect the integrity of piling wall while at the same time encouraging the reestablishment of riparian vegetation. Over time, as the barbs experience a range of higher discharge, the functional bank and a portion of the thalweg of the Yakima River will move away from its present location. Scour pools will develop at the toe of each barb, providing holding cover for adult and rearing cover for juvenile salmonids. Uneven channel adjustments that have favored bedload transport through the lower, incised left (east) channel of the river in this location has caused cobbles and gravels to accumulate near the head end of the right (west) channel, adjacent to the proposed barb location. At higher flows, the two rock barbs (in conjunction with downstream drop structures) may help to equilibrate bedload transport through the reach, and decrease the need for inwater bedload removal by the WIP to ensure adequate discharge into the WIP Main Canal. More natural sediment transport and deposition mechanisms might help to improve the overall quality of native fish habitat in this small reach of the Yakima River.

Removing stockpiled bedload at the upstream end of the mid-river island will drop the elevation of the island, and allow the Yakima River to access its floodplain over a wider range of flows. This interaction will encourage the growth of riparian vegetation, and the porous nature of floodplain cobbles and gravels will promote easy access to water, thus producing hydroperiods more amenable to native vegetation. Further, scalping down the upstream end of the island is an integral part of the flood control plan because higher flows will interact with downstream rock structures intended to spread floodwater across the floodplain and relieve pressure on Wapato Dam. This element of the proposed action encourages more normative interactions between the river and its floodplain, and signifies a willingness on the part of the BIA to allow natural mechanisms to occur that may ultimately reduce the amount of potentially injurious maintenance they must perform in the Yakima River near Wapato Dam.

The installation of two rock barbs and five rock drop structures in the Yakima River is intended to promote natural physical processes and decrease future invasive maintenance activities (*e.g.*, mechanical removal of bedload from the active channel). Therefore, the biological effects are expected to be minimal in extent. When bed mobility is highest (high magnitude flow events), MCR steelhead will seek refuge in areas where velocities and sediment movement are not hazardous, or, depending on life stage, will be either immigrating or emigrating the Yakima River Basin and the Action Area. Further, slackwater habitat and pools created by the construction of rock structures will provide refugia for MCR steelhead during times of elevated discharge. Since the bank barbs and drop structures will encourage the river to occupy more of its available channel area (*i.e.*, encourage aggradation in scoured reaches), each channel of the Yakima River may assume a more natural condition, and MCR steelhead can rely on refuge mechanisms under which they naturally evolved. The proposed action will create additional rearing habitat in the Action Area through the creation of a perennially flowing overflow channel down the left margin of the mid-river island. This element of the proposed action will utilize a pre-existing distributary conduit of the Yakima River, and create valuable off-channel rearing habitat and refugia for native fish. As a matter of the environmental baseline, the construction elements of the action under consultation will most likely improve the Channel Condition and Dynamics (Width/Depth Ratio and Floodplain Connectivity indicators) and Habitat Elements (Refugia and Off-Channel Habitat indicators) pathways of the MPI. Additionally, in the MPI analysis, the proposed action may improve the Habitat Access pathway (Physical Barriers indicator) by elevating the water surface along the downstream sides of both the East and West Dams, thus improving hydraulic conditions at all three fish ladders.

2.1.3.2 Indirect Effects

Indirect effects are caused by the proposed action, are later in time, and are reasonably certain to occur (50 CFR 402.02). Indirect effects may occur outside of the area directly affected by the action. Indirect effects may include the effects of other Federal actions that have not undergone section 7 consultation, but will result from the action under consultation. These actions must be reasonably certain to occur, or be a logical extension of the proposed action. The indirect effects resulting from the proposed Wapato Dam flood control project include (1) sediment deposition and the formation of scour pools adjacent to each instream rock drop and barb, (2) alteration of floodplain and channel morphology, and (3) riparian vegetation changes along channel margins and on the floodplain of the Yakima River.

2.1.3.2.1 Sediment Deposition and Scour Pools

Instream structures such as rock drops and bank barbs produce hydraulics that can cause immediate adjustments in bank and bed, and encourage long-term changes in channel location and morphology. After the instream rock structures are installed, sediments will begin accumulating on the upstream side of each rock drop, and both sides (although mostly in the downstream velocity shadow) of each bank barb. Sediments settling out behind the bank barbs will cover the previously scoured footing of the sheet-pile wall and help to eliminate future erosion. Additionally, aggraded areas adjacent to each barb will eventually be colonized by riparian vegetation that will, in turn, capture suspended solids carried by overbank flows, thus promoting bank formation and structural integrity.

During the first high flow event following construction, cobbles and gravels will begin to accumulate along the upstream face of each rock drop. This aggradation will improve the structural integrity of each drop structure by further filling void spaces between large rocks, which will help seal the structures and add to their efficiency. The Yakima River will begin to equilibrate the energy gradient in the East channel in a more normative manner because bedload deposition will flatten channel slope, widen the channel, and encourage access to lateral floodplain areas. Drop structures in the West channel will interact with the river in the same manner, and although the final design encourages a preferential high flow path down the East channel, the Yakima River will occupy floodplain areas instead of attacking Wapato Dam. Sediments accumulating on the upstream face of each instream Yakima River drop structure may provide spawning substrate for native fish assemblages, and will improve bedform heterogeneity that is vital to native benthic species assemblages.

Sediment recruitment into areas that have been subjected to unnatural scour conditions (*e.g.*, below the East Dam) is viewed as a beneficial effect, however, there will also be some cost in terms of habitat loss. The area accumulating sediments includes habitats that are used by salmonids and potentially MCR steelhead. However, the net effect of drop structures below Wapato Dam will be an overall increase in rearing and holding habitat for juvenile and adult steelhead, as well as other native anadromous fish. Two new scour pools will form below rock drops constructed in the West channel, and four new scour pools will form below rock drops constructed below the East Dam. The depth of the existing tailwater pools below both dams will be increased by approximately three feet, increasing their extent and functional habitat quality as well as improving hydraulic conditions at the three fish ladders in Wapato Dam. Additionally, an assortment of bed sediments will recruit and come to reside in areas largely composed of bedrock that presently provide only marginal MCR steelhead habitat. Further, two scour pools will form, over time, at the toe of each rock barb. The overall indirect effect of these new pools is expected to be a net improvement in baseline conditions (*i.e.,* pool quality and refugia) through improved habitat complexity (see below).

2.1.3.2.2 Alteration of Channel and Floodplain Morphology

At the upstream end of the Action Area, Union Gap confines the planform and gradient of the Yakima River. When the river exits this massive hydraulic control, there is a natural tendency for sediment to drop out of the water column and form an alluvial fan. Since the last glaciation, the Yakima River in the Action Area has resided on a large alluvial fan that begins below Union Gap and extends more than 20 miles to the west, and more than 25 miles downstream. Alluvial fans are unique geomorphic features that maintain a dynamic equilibrium of discharge and sediment by delicate adjustments to stream gradient. Rivers flowing across alluvial fans tend to create several distributary channels that radiate from the apex like fingers on a hand, and these channels are alternately active, as a function of the magnitude and duration of runoff, throughout the water year. As the river builds the fan by dropping bedload, it fills old channels and excavates new ones. Because the overall slope of an alluvial fan is relatively flat, the stream can spread out into several distributary channels at high discharges and expend energy by reducing water velocity and stream power, thus maintaining a relatively stable planform and lessening the severity of flooding downstream. Presently, however, floodplain revetments and Wapato Dam in the Action Area have altered pre-development vertical and lateral adjustment mechanisms that maintained the physical structure and function of the alluvial fan.

The Yakima River, bounded by roadway prisms that bracket the channel margins of the Action Area, encounters Wapato Dam, and this large grade control (*i.e.*, a wide flat spot) has altered sediment transport dynamics by providing a hardened crest built at equal elevation for more than 600 feet across the floodplain. Further, the mid-river island, in conjunction with Wapato Dam and floodplain revetments, has forced the river to occupy two separate channels. As is usually the case in rivers flowing across alluvial fans under these natural and human-induced conditions, the Yakima River has developed a preferential flow path down one channel (East channel), and deposited the majority of its sediments in the other (West channel). Faced with a bedload management issue, the BIA has attempted to force the Yakima River into these two channels by removing bedload from the West channel and piling it around the upstream margin of the tip of the mid-river island. Floodplain activities undertaken to maintain the Yakima River into two flow conduits has only produced a situation where uneven and dramatic channel adjustments have taken place, especially during high flow events.

The Wapato Dam flood control project will remove floodplain features and construct instream structures that will help the Yakima River express a more natural interaction with its floodplain. During the first major flow event, the Yakima River will be able to occupy the upstream end of the mid-river island. As it flows across the floodplain, drop structures in the main channels and on the floodplain will conduct water down the mid-river island into the overflow channel. Floodplain drop structures are sized and oriented to maintain an even energy gradient, and maximize the areal extent of floodplain surface over which the Yakima River can flow. Geomorphic processes, including sediment mobilization and deposition, adjustments to channel morphology and position, and creation of a perennial stream channel along the left margin of the mid-river island will continue over time, punctuated by intensive fluvial action during high water events. A new equilibrium between river channel and floodplain will be reached, driven by sediment competent streamflows (*e.g.*, spring runoff, rain-on-snow and/or rain-on-melting-snow events) that will mobilize and redistribute bed sediments (cobbles and gravels). The net result will be a substantial increase in the areal extent and habitat function of the Yakima River and its floodplain throughout the Action Area, significantly improving channel and floodplain conditions than exist under the environmental baseline.

At smaller scales, the rock drop structures will have several impacts on the existing channel morphology of the Yakima River. Each drop structure will incorporate vertical heterogeneity into the horizontal profile of the river, while at the same time acting as a step that creates a small amount of hydraulic head (about 1.5 feet). As water encounters each rock drop, it will decelerate, deposit sediments, and then increase velocity again while falling over the structure and flowing downstream. Near the center of each instream drop structure, a boat notch will help concentrate discharge that will form a scour pool directly downstream, and prevent the rock drop from becoming a potential barrier to passage. Construction of most instream drop structures will include LWD addition, and revegetation efforts will encourage the establishment of native riparian species. Installing two rock barbs along the right bank upstream of Wapato Dam adjacent to the sheet-piling wall will turn the Yakima River away from this revetment, and will help promote more natural processes by spreading discharge (requiring smaller amounts than under the current baseline) across the channel. Overall, sediment transport dynamics will benefit, and greater habitat complexity for native aquatic species assemblages will result. Additionally, the channel of the Yakima River in the Action Area will better process elements vital to the entire aquatic foodweb (Stanford and Ward 1993).

The overall effect of alterations to the channel and floodplain morphology of the Yakima River within the Action Area will be beneficial to listed MCR steelhead. Increases in the vertical heterogeneity of the Yakima River channel by adding drop structures will be an improvement over the existing environmental baseline, especially in the East channel. As described earlier, this channel has incised to bedrock, and is vertically and laterally simplified with a relatively homogeneous substrate composition. All instream rock structures will increase the functional habitat value of the Action Area by providing slackwater resting areas for adults and juvenile salmonids, as well as areas where sediment accretion will help foster the growth of riparian plants. The creation of a perennial stream in the overflow channel will substantially improve the functional condition of the Habitat Elements pathway by adding off-channel habitat that will provide important refugia for native salmonids. Some of the instream drop structures will incorporate LWD that will serve to slightly improve the Habitat Elements (LWD indicator) pathway of the MPI over the baseline condition. Additionally, bank barbs and rock drop structures will improve the Channel Condition and Dynamics (Width/Depth Ratio and Floodplain Connectivity indicators) and Habitat Elements (Pool Quality and Pool Frequency indicators) pathways of the MPI as compared to the baseline condition.

2.1.3.2.3 Alteration of Riparian Vegetation

Riparian ecosystems are transitional zones between the riverine and adjacent terrestrial environment. Accordingly, the structure and function of riparian zones are among the most diverse, dynamic, and complex of all terrestrial ecosystems (Gregory *et al.* 1991; Naiman *et al.* 1993; Naiman and Décamps 1997; Hedin *et al.* 1998; Lyon and Sagers 1998). Riparian zones regulate the flow of energy and materials between terrestrial and aquatic environments along the river continuum (Vannote *et al.* 1980; Naiman *et al.* 1993; Naiman and Décamps 1997). Healthy riparian vegetation serves many important roles in the ecological health of a river, including producing LWD, stabilizing riverbanks, and interacting with and contributing to aquatic foodwebs (Karr and Schlosser 1978; Gregory *et al.* 1991; Stanford *et al.* 1996; Naiman and Décamps 1997). Additionally, riparian vegetation intercepts and stores energy from solar radiation, which directly influences (*i.e.,* moderates) stream temperature and serves as an energy source (detrital inputs) for aquatic biota along the river continuum (Vannote *et al.* 1980; Gregory *et al.* 1991; Tabacchi *et al.* 1998; Poole and Berman 2001).

Riparian vegetation throughout the action area has been impacted by floodplain development activities and regulated flow regimes that have inhibited interactions between the river and its floodplain. Additionally, land management activities have directly removed riparian vegetation and replaced native riparian forests with orchards and/or floodplain gravel pits. Native riparian community assemblages are reliant upon frequent overbank flooding, stable and accessible groundwater tables, and streamflows whose timing, magnitude, and duration approximate pre-development conditions. When conditions are altered such that any one or combination of these factors are impacted, native riparian communities cannot persist, are diminished, and nonnative invader species find amenable growing conditions. As the adjacent riverscape becomes increasingly disconnected and fragmented, native aquatic and riparian species experience increasingly more growth and survival conditions.

The Wapato Dam flood control project will help promote more natural interactions between the Yakima River and its floodplain through creation of a perennially flowing overflow channel, provision of flow pathways across the floodplain at high flows, increased water table elevations over a greater portion of the irrigation season, and removal of physical obstructions intended to force the river to occupy two channels. The combined effect of the flood control elements of the proposed action will be the promotion of hydrologic and edaphic conditions that will foster the growth and development of native riparian vegetation. Cottonwood, a species in sharp decline in the Yakima Basin below Union Gap (Braatne and Jamieson 2001), may find suitable floodplain areas with adequate hydroperiod to enable growth, establishment, and over time, regeneration of floodplain galleries shown to be important to the structure and function of alluvial river systems (Tabacchi *et al.* 1998; Rood and Mahoney 2000). To help encourage this process, the BIA will plant 10 rooted cottonwoods for every adult cottonwood tree destroyed during construction. In comparison to the environmental baseline for this reach of the Action Area, the proposed project will improve the Watershed Conditions pathway (Riparian Reserves indicator) of the MPI.

2.1.3.3 Population Level Factors

As detailed in Section 2.1.2.2, NOAA Fisheries has estimated the median population growth rate (lambda) for MCR steelhead, a species potentially affected by the Wapato Dam flood control project. Under the environmental baseline, life history diversity has been limited by the influence of hatchery fish, by physical barriers that prevent migration to historical spawning and/or rearing areas, and by water temperature barriers that influence the timing of emergence, juvenile growth rates, or the timing of upstream or downstream migration. Additionally, flow regulation and irrigation development has profoundly altered the riverine environment and those habitats vital to the survival and recovery of the MCR ESU.

The Wapato Dam flood control project is expected to add temporary, construction-related detrimental effects to the existing environmental baseline. Conversely, certain aspects of the action under consultation will benefit fisheries habitat as compared to the baseline condition over the long-term (*e.g.*, riparian plantings, floodplain restoration, creation of perennial off-channel habitat). However, these effects, as detailed above, are not expected to have any significance on MCR steelhead at the population scale. Therefore, NOAA Fisheries believes that the proposed action is unlikely to adversely influence existing population trends, habitat and hydrology, life-history diversity, or the influence of hatcheries on the ESU compared to conditions under the environmental baseline.

2.1.4 Cumulative Effects

Cumulative Effects are defined in 50 CFR 402.02 as "those effects of future state or private activities, not Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation." For this analysis, cumulative effects for the general Action Area are considered. Future Federal actions, including the ongoing operation of hatcheries, irrigation projects, fisheries, and land management activities have been or will be reviewed through separate section 7 consultation processes.

It is expected that a range of non-Federal activities would occur within the Yakima River Basin for the purposes of restoring and enhancing fish habitat. These activities would likely include installing fish screens, improving flow management and irrigation efficiency, restoring instream and riparian habitat, and removing barriers to passage. Although the specific details of individual projects are lacking, it is assumed that non-Federal conservation efforts would continue or increase in the near future.

The State of Washington has also implemented a number of strategies to improve habitat for listed species. The 1998 Salmon Recovery Planning Act provided the framework and a funding mechanism for developing watershed restoration projects. It also created the Governor's salmon Recovery Office to coordinate and assist in the development of salmon recovery plans. Washington's "Statewide Strategy to Recover Salmon," for example, is designed to improve watersheds (NMFS 2000).

The Watershed Planning Act, also passed in 1998, encourages voluntary planning by local governments, citizens, and Tribes for water supply and use, water quality, and habitat at the Water Resource Inventory Area or multi-Water Resource Inventory Area level. Grants are made available to conduct assessments of water resources and to develop goals and objectives for future water resources management. The Salmon Recovery Funding Act established a board to localize salmon funding. The board will deliver funds for salmon recovery projects and activities (NMFS 2000).

The WDFW and tribal co-managers have been implementing the Wild Stock Recovery Initiative since 1992. The co-managers are completing comprehensive species management plans that examine limiting factors and identify needed habitat activities. The plans also concentrate on actions in the harvest and hatchery areas, including comprehensive hatchery planning. The department and some western Washington treaty Tribes have also adopted a wild salmonid policy to provide general guidance to managers on fish harvest, hatchery operations, and habitat protection and restoration measures to better protect wild salmon runs (NMFS 2000).

Water quality improvements may result from the development of total maximum daily load restrictions (TMDL) for a range of pollutants. The state of Washington is under court orders to develop TMDL management plans for each water body listed as water quality limited under section 303(d) of the Clean Water Act. It has developed a schedule that is updated yearly; the schedule outlines the priority and timing of TMDL plan development (NMFS 2000).

In addition to potential beneficial projects, it is also likely that much of the private land management and water regulation will continue under existing conditions. In general, floodplain development and resource extraction, urbanization, and infrastructure expansion will continue to provide harmful effects to listed salmonids and their habitat. Specific activities such as farming in or adjacent to sensitive riparian areas, allowing livestock to access sensitive waterways, and tributary diversions that (1) remove large volumes of water and (2) block access to quality habitats will continue to adversely affect listed MCR steelhead.

2.1.5 Conclusion/Opinion

NOAA Fisheries' jeopardy analysis is based upon the current status of the species, the environmental baseline for the Action Area, and the effects of the proposed action. The analysis takes into account the species' status because determining the impact upon a species' status is the essence of the jeopardy determination. Depending upon the specific considerations of the analysis, actions that are found likely to impair currently properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat towards PFC at the population or ESU scale will generally be determined likely to jeopardize the continued existence of listed salmon. Specific considerations include whether habitat condition was an important factor for decline in the listing decision, changes in population or habitat conditions since listing, and any new information that has become available (NMFS 1999).

The proposed action is likely to cause short-term adverse effects on listed salmonids by modifying habitat and construction activities. These effects are unlikely to reduce salmonid distribution, reproduction, or numbers in any meaningful way. Therefore, NOAA Fisheries has determined that the effects of the proposed action will not jeopardize the continued existence of the MCR steelhead ESU. This determination of no jeopardy is based upon the current status of the species, the environmental baseline for the Action Area, and the effects of the proposed action.

However, the instream construction elements of the Wapato Dam flood control project will create short-term direct effects with a more than negligible chance of causing incidental take. The most significant risks are posed by (1) the temporary increase in turbidity that will occur during instream excavation and rock placement and/or future maintenance activities, and (2) mechanical injury to MCR steelhead attendant to instream construction and excavation and/or future maintenance activities. The risk of take will be minimized by the implementation of conservation measures, WDFW Hydraulic Permit Approval provisions, and construction timing restrictions as set forth in this Opinion. At no time, and without contingencies, will the activities described in this Opinion have levels of take or destroy habitat that would appreciably reduce the likelihood of survival and recovery of MCR steelhead.

2.1.6 Reinitiation of Consultation

This concludes formal consultation for the Wapato Dam flood control project. Consultation must be reinitiated if (1) the amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the action is modified in a way that causes an effect on listed species that was not previously considered; or (4) a new species is listed (50 CFR 402.16). NOAA Fisheries will be monitoring the listed Reasonable and Prudent Measures (RPMs) and terms and conditions of the incidental take statement. NOAA Fisheries may reinitiate consultation if the above measures are not adequately completed, resulting in increased probability of take to listed species. To reinitiate consultation, the BIA should contact the Habitat Conservation Division (Washington Habitat Branch Office) of NOAA Fisheries. Upon reinitiation, the protection provided by this incidental take statement, section 7(o)(2), becomes invalid.

2.1.7 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or Critical Habitat, to help implement recovery plans, or to develop additional information.

To encourage greater habitat diversity near the project area, NOAA Fisheries recommends increasing riparian planting in the upstream and downstream vicinity of the project, and placing LWD along the riverbanks. Placing LWD may encourage higher densities of juvenile MCR steelhead (Peters *et al.* 1998). Presently, the Yakima River in the Action Area lacks the habitat heterogeneity essential for reaching PFC.

NOAA Fisheries must be kept informed of actions minimizing or avoiding adverse effects, or those that benefit listed species or their habitat. Accordingly, NOAA Fisheries requests notification of the implementation of any conservation recommendations.

2.2 Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4 (d) of the Act prohibit the take of endangered and threatened species without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct (50 CFR 217.12). Harm is further defined as significant habitat modification or degradation that results in death or injury to listed species by "significantly impairing essential behavioral patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR 222.102). Incidental take is take of listed animal species that results from, but is not the purpose of, the Federal agency or applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and is not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary; in order for the exemption in section 7(o)(2) to apply, they must be implemented by the action agency so that they become binding conditions of any grant or permit issued to the applicant as appropriate. The BIA has a continuing duty to regulate the activity covered in this incidental take statement. If the BIA fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. The take statement also provides RPMs that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply to implement the RPMs.

2.2.1 Amount or Extent of Take Anticipated

As stated in Section 2.1.1, above, MCR steelhead use the Action Area for migratory purposes, and possibly rearing. Based on information reported in YSS (2001), Phelps *et al*. (2000), Hockersmith *et al.* (1995), and Busack *et al.* (1991), MCR steelhead are likely to be present in the Action Area any day of the year. Therefore, incidental take of MCR steelhead is reasonably certain to occur from the construction elements of the proposed action. The proposed action includes measures to reduce the likelihood and amount of incidental take. Some elements of the proposed action are necessary to minimize the impact of such incidental taking, and so are included as RPMs.

Take caused by the proposed action is likely in the form of harm, where habitat modifications will impair normal behavior patterns of listed salmonids. Harm is likely to result from mechanical injury, damage from turbidity and/or sedimentation, or temporary lost foraging opportunities caused by displacement of benthic production areas with instream structures. The amount of take from these causes is difficult, if not impossible to estimate. In instances where the number of individual animals to be taken cannot be reasonably estimated, NOAA Fisheries uses a surrogate approach to estimate the extent. The surrogate should provide an obvious threshold of authorized take which, if exceeded, provides a basis for reinitiating consultation.

This Opinion analyzes the extent of effects that would result to MCR steelhead from adding approximately 6,800 cubic yards of instream rock structures that will cover approximately 36,400 square feet of benthic habitat in the Action Area. The number of instream rock structures that will be built from this volume of rock include five rock drops and two bank barbs. The effects of covering this amount of benthic habitat have been minimized by (1) the creation of a 3,000-foot long perennial overflow channel that provides year-round rearing and refuge habitat, (2) the restoration of access by the Yakima River to at least 60,000 square feet of floodplain, and (3) raising the low-pool tailwater elevation below Wapato Dam by three feet, thus ensuring better passage conditions at three fish ladders. Despite the use of the best scientific and commercial data available, NOAA Fisheries cannot estimate the number of fish that would be injured or killed by these occurrences. Therefore, the extent of take anticipated in this statement is that which would occur from the construction and maintenance (10 year period) of five instream rock drops and two bank barbs requiring approximately 6,800 cubic yards of rock covering about 36,400 square feet of benthic habitat. Should any of these thresholds be exceeded during project activities, the reinitiation provisions of this Opinion apply.

2.2.2 Reasonable and Prudent Measures

The measures described below are non-discretionary. They must be implemented so that they become binding conditions in order for the exemption in section 7(a)(2) to apply. The BIA has the continuing duty to regulate the activities covered in this incidental take statement. If the BIA fails to adhere to the terms and conditions of the incidental take statement through enforceable terms added to the document authorizing this action, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

NOAA Fisheries believes that the following RPMs, along with conservation measures described by the BIA, are necessary and appropriate to minimize the take of ESA-listed fish resulting from implementation of this Opinion.

1. The BIA will minimize take by incorporating best management practices (BMPs) to reduce potential impacts of staging and onshore construction activities.

2. The BIA will minimize take by incorporating BMPs to reduce potential impacts of instream construction activities.

3. The BIA will minimize take by ensuring development of functional riparian habitat.

4. The BIA will minimize take by performing only those future maintenance activities described in Section 1.3.5 of this Opinion.

5. The BIA will minimize take by incorporating appropriate timing restrictions during project construction and future maintenance activities.

2.2.3 Terms and Conditions

To comply with ESA section 7 and be exempt from the prohibitions of section 9 of the ESA, the BIA must ensure compliance with the following terms and conditions, which implement the RPMs described above. These Terms and Conditions largely reflect measures described as part of the proposed action in the BA and the foregoing Opinion. NOAA Fisheries has included them here to ensure that the action agency is well aware that they are non-discretionary.

To implement RPM No. 1 (minimize staging and onshore construction impacts) the BIA shall ensure that in addition to their proposed conditions:

1. A temporary erosion and sediment control (TESC) plan will be implemented.

2. A spill prevention, control, and containment (SPCC) plan will be implemented.

3. Hydraulic fluid in heavy equipment will be replaced with mineral oil or other biodegradable, non-toxic hydraulic fluid.

4. All heavy equipment will be clean and free of external oil, fuel, or other potential pollutants.

To implement RPM No. 2 (minimize instream construction impacts) the BIA will ensure that:

1. Prior to any instream construction activities on rock structures, any and all large equipment intended for instream use will be steam cleaned, and free of external oil, fuel, or other potential pollutants.

2. During construction of the rock drops and barbs, work will progress from the banks of the river towards the center and the excavator will travel on previously placed rocks.

3. Off-road haul trucks may only cross the Yakima River to access the mid-river island via the bedrock control in the East channel, or by traveling across a completed drop structure. The BIA will designate one drop structure as the primary crossing, and only use this crossing in the future to access the mid-river island.

4. Rock placement will be done only by a qualified excavator operator.

5. Instream operation of off-road haul trucks will be done only by a qualified operator.

6. Any fill material entering the Yakima River will be clean, free of fines, and will consist of native rock. No outside fill will be trucked into the worksite; only cobbles and gravels excavated from the upstream end of the mid-river island are allowed for use as fill.

To implement RPM No. 3 (development of functional riparian habitat) the BIA will ensure that:

1. Access and travel corridors along both banks of the Yakima River in the Action Area will utilize existing roads and/or previously disturbed areas.

2. To the maximum extent possible, floodplain drop structures constructed across vegetated portions of the mid-river island will be oriented and built to capitalize on pre-existing, non-vegetated corridors.

3. Each and every adult cottonwood tree destroyed during floodplain construction activities will be replaced with rooted cottonwood stock at a ratio of 10 to 1. These rooted stock will be planted on pre-existing or constructed areas that exhibit the best possible growth conditions.

4. Additional riparian plantings will occur at the keys of each bank barb and drop structure.

5. All plantings will use native species appropriate for riparian use and will be planted by hand tools, mechanical methods that increase the probability of survival (*e.g.,* stingers), and/or during construction when disturbance has already occurred or is ending.

6. All disturbed upland sites, including the two cross dikes, will be broadcast seed with a mixture of native grasses when construction is finished.

To implement RPM No. 4 (future maintenance activities) the BIA will ensure that:

1. At least two weeks prior to future inwater maintenance activities, the BIA will notify NOAA Fisheries, in writing, of the scope and magnitude of their intentions to ensure compliance with activities as described in Section 1.3.5 of this Opinion. Written notification will be sent to:

   NOAA Fisheries
   Habitat Conservation Division
   Washington Habitat Branch Office
   Attn: 2001/02046
   510 Desmond Drive S.E., Ste. 103
   Lacey, WA 98503-1273

2. Prior to any instream construction activities on rock structures, any and all large equipment intended for instream use will be steam cleaned, and free of external oil, fuel, or other potential pollutants.

3. The mid-river island will only be accessed via the rock drop designated by the BIA, as described in RPM No. 2. If this structure becomes damaged and will not allow safe passage, then the BIA must reinitiate consultation.

4. Instream work will only include minor adjustments, alterations, or repair of existing rock drop structures using original structural rocks. No additional instream excavation or rock addition will be permitted.

5. The base flow notch in rock drop number three will be monitored and adjusted as needed to ensure perennial flow of approximately 10 cfs into the overflow channel.

6. Low flow notches in drop structures near the three fish ladders will be monitored and adjusted to ensure that hydraulic conditions allow proper fishway operation.

7. Gravel removal after high flow events will only occur in the dry.

8. Rock structures will be kept clear of trees and other debris that affects structural integrity and operation, navigability, and/or fish passage. Any LWD removed from rock drop structures will be relocated into the active channel of the Yakima River below the downstream-most rock drop.

To implement RPM No. 5 (work windows) the BIA will ensure that:

1. Instream work during construction or future maintenance activities will only occur from July 15 to September 30 in any given year.

3.0 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2));

- NOAA Fisheries shall provide conservation recommendations for any Federal or State activity that may adversely affect EFH (§305(b)(4)(A));

- Federal agencies shall within 30 days after receiving conservation recommendations from NOAA Fisheries provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.110). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies regarding any activity that may adversely affect EFH, regardless of its location.

The objectives of this Essential Fish Habitat (EFH) consultation are to determine whether the proposed action may adversely affect designated EFH, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse impacts to EFH resulting from the proposed action.

3.2 Identification of EFH

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years) (PFMC 1999). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999; see: http://www.pcouncil.org/salmon/salother/a14.html). Assessment of the impacts to these species' EFH from the proposed action is based, in part, on these descriptions and information provided by the BIA.

3.3 Proposed Actions

The proposed action and Action Areas are detailed above in Sections 1.3 and 1.4 of this Opinion. The Action Area contains habitats that have been designated as EFH for various life-history stages of chinook and coho salmon.

3.4 Effects of Proposed Actions

As described in detail in Section 2.1.3 of this Opinion, the proposed activities may result in detrimental short- and long-term impacts to a variety of habitat parameters. These adverse effects are:

1. As described in Section 2.1.3.1.1, the proposed action will result in a short-term degradation of water quality (turbidity) because of instream construction activities and future maintenance activities.

2. As described in Section 2.1.3.1.2, the proposed action will result in a short-term disturbance of streambed and banks that could pose a risk of mechanical harm, and will temporarily displace 36,400 square feet of benthic habitat.

3.5 Conclusion

NOAA Fisheries believes that the proposed action may adversely affect designated EFH for chinook and coho salmon.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions that would adversely affect EFH. While NOAA Fisheries understands that the conservation measures described in the BE will be implemented by the BIA, it does not believe that these measures are sufficient to address the adverse impacts to EFH described above. NOAA Fisheries does believe that the temporary turbidity created by the project is already minimized to the maximum extent practicable by the conservation measures described in the BA. Consequently, NOAA Fisheries recommends that the BIA implement the following conservation measures to minimize the remaining adverse effects to EFH of chinook and coho:

1. To minimize adverse effect 3.4.1 (adverse effects from future maintenance activities) adopt all Terms and Conditions described in Sections 2.2.3.4 and 2.2.3.5.

2. To minimize adverse effect 3.4.2 (mechanical harm and benthic habitat displacement), adopt all Term and Conditions described in Section 2.2.3.2.

3.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

As detailed in the preceding paragraph, the BIA must supply a written responses to NOAA Fisheries' EFH conservation recommendations to the following address within 30 days of receipt of this Opinion:

NOAA Fisheries
Ellensburg Field Office
Attn: 2001/02046
304 S. Water St., Ste. 201
Ellensburg, WA 98926

3.8 Supplemental Consultation

The BIA must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(k)).

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